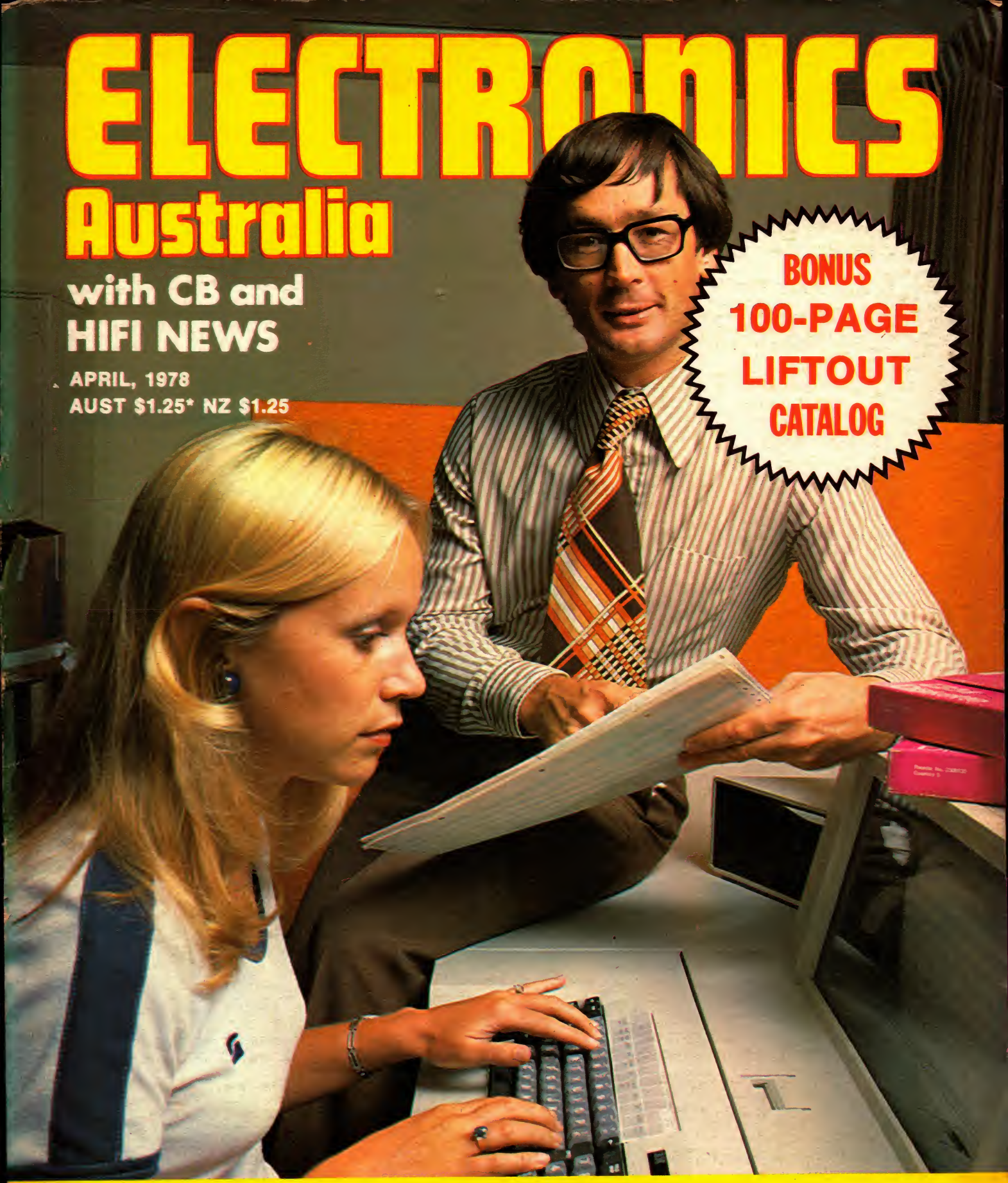
ELECTRONICS Australia

with CB and HIFI NEWS

APRIL, 1978
AUST $1.25* NZ $1.25

BONUS 100-PAGE LIFTOUT CATALOG



DIGITAL PHOTO-TIMER • COMPUTER DOOR CHIME KIT

LOW COST 33RPM DISC OF "2650" MICRO PROGRAMS!

When you're serious...

TC788-4

TC880-2

Sony Reel-to-Reel Decks

If you're through fooling around with Hi-Fi and are ready for some serious sound experiences, get creative with a studio-quality reel-to-reel deck by Sony.

Sony started out first – with Japan's first-ever magnetic tape recorder back in 1950. And in the 28 years since we've maintained our position by applying the results of our massive research into continuing improvements in every aspect of reel-to-reel deck design and manufacture.

That's why when you specify a Sony deck you'll be in great company! Many of the world's best known musicians choose Sony for their personal rigs.

And for good reasons:

Take our state-of-the-art TC880-2 for instance:

- Sony's famous closed-loop dual-capstan drive with Direct Tape Drive gives exceptionally low wow & flutter of 0.02%
- 3 motor – 4 head system including 4 track playback head for accurate and stable tape transport
- Built-in differential amplifier and phase compensator circuit reproduce sound so accurately as to be indistinguishable from source
- Foolproof logic controls with full range of bias and equalisation switches
- Synchro track facility allows sound-on-sound with no time lag for accurate after recording or sound editing.

And if your musical ideas need a studio-quality 4 track record and playback facility go no further than Sony's mighty TC788-4:

- Full versatility with 4 track 4 channel recording and playback, 4 track 2 channel recording and playback, or "Pan-pot" for front to back mixing.
- Synchro track feature for sound-on-sound with no time lag, accurate 'after recording' or sound editing
- All the other features that have made Sony No. 1 in reel-to-reel, such as closed-loop dual-capstan drive, 3 heads for simultaneous monitoring; servo-controlled 3 motor system for accurate tape transport.

These are but two of Sony's full range of reel-to-reel decks. Any one of them will turn your Hi-Fi rig into a truly creative audio instrument.

SONY.

Research makes the difference.

GAC.S.9646

ELECTRONICS Australia

Australia's largest selling electronics & hi-fi magazine

On sale the first Monday of each month

VOL. 40 No. 1 APRIL, 1978

This new photographic timer utilises all digital circuitry, has a red LED display and can count from 0.1-99 seconds. Full constructional details begin on p38.

FEATURES

HIFI NEWS AND REVIEWS

PROJECTS AND CIRCUITS

AMATEUR RADIO, CB SCENE, DX

COLUMNS

DEPARTMENTS

Dick Smith catalog

This issue carries a special bonus insert — a big 100-page "Super-catalog" from Dick Smith Electronics. Normally costing 75c, it includes not only products and prices, but data information, ideas and circuits as well. You'll find it following page 60.

On the cover

Most readers will have already recognised the central figure on this month's cover. It's none other than Dick Smith, shown here with his IBM System/32 computer and Miss Carline Archbold. We tell the story of Dick and his computer on p8. (Photo by Philip Weir Photography.)

How to get the sound of a whole new hi-fi system for around $35

Are you sure of the quality of your loudspeakers? Most people can't afford top quality speakers at first. So they upgrade the speakers later. If you're at that stage, you will know you're not going to do it for less than $200-$300 — not meaningfully. We offer an alternative.

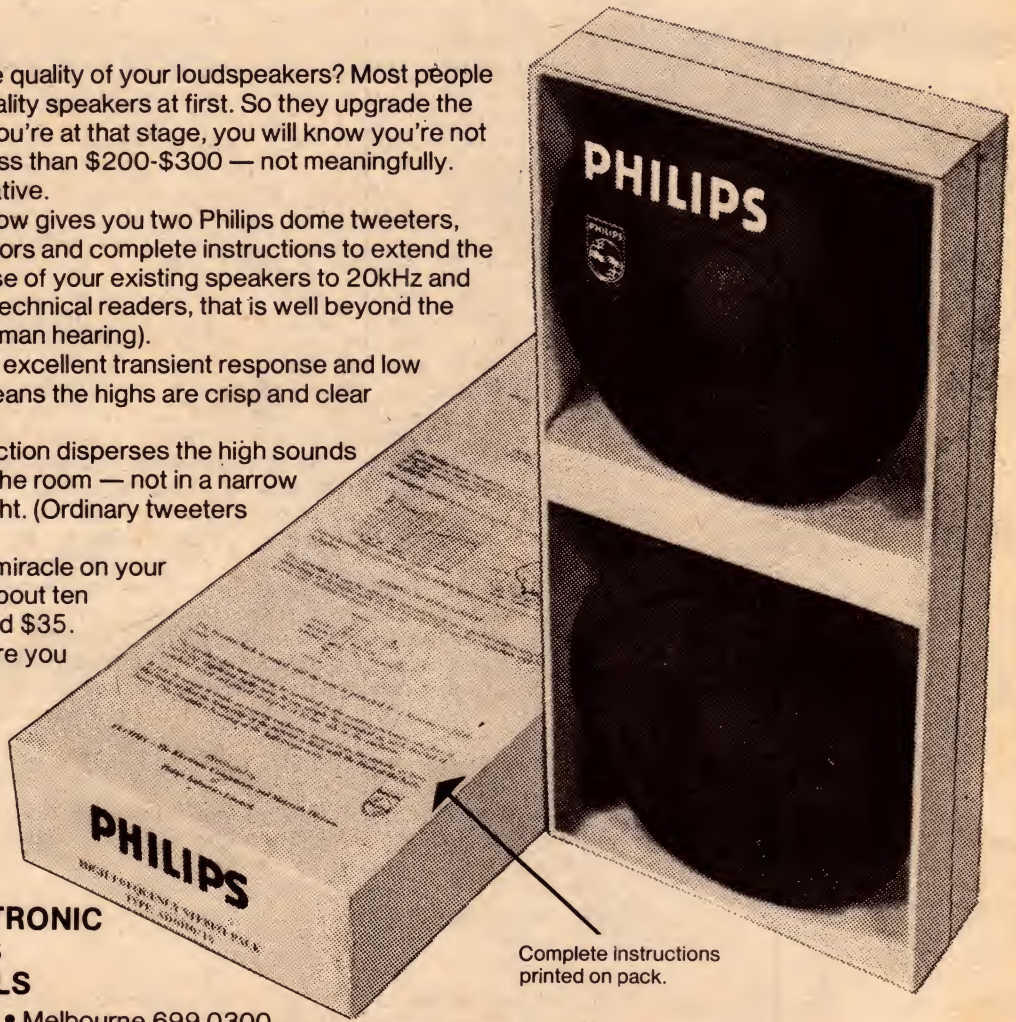
The Elcoma kit below gives you two Philips dome tweeters, cross-over capacitors and complete instructions to extend the frequency response of your existing speakers to 20kHz and beyond. (For non-technical readers, that is well beyond the range of normal human hearing).

And they do it with excellent transient response and low distortion. (That means the highs are crisp and clear without grating).

The dome construction disperses the high sounds naturally all round the room — not in a narrow beam like a flashlight. (Ordinary tweeters can do that).

You can work this miracle on your stereo system in about ten minutes. For around $35.

Why not try it before you write a cheque for $300?



Complete instructions printed on pack.

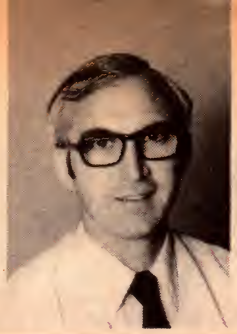
PHILIPS ELECTRONIC COMPONENTS AND MATERIALS

Sydney 427 0888 • Melbourne 699 0300
• Brisbane 44 2471 • Adelaide 223 4022 • Perth 277 4199

PHILIPS **Electronic Components and Materials**

PHILIPS

BA.EL2



Editorial Viewpoint

Top priority for the P & T

About this time last year, before CB radio was legalised, I remember a number of radio amateurs telling me about an international underground organisation whose alleged goal was to produce chaos, if not anarchy on the world's radio communication bands. At the time I was disinclined to take the story seriously, because apart from anything else, the intended inference seemed to be that all users of CB radio were potential anarchists.

Since that time I've seen no real evidence supporting the existence of such a deliberate plan, and frankly I'm still sceptical. However what does worry me are the reports of unorganised or "ad hoc" radio piracy, and the mounting evidence that more and more individuals and groups are adopting an attitude of "fair game" towards the whole of the electromagnetic spectrum.

A few weeks ago, one of the local CB publications carried a report of an interview with three young inventors who had produced a device claimed to solve CB interference with TV receivers and audio systems. The device itself turned out to be a low power transmitter, which apparently functions by jamming — hardly a responsible way of dealing with electromagnetic pollution. However much more disturbing than this was the reported attitude of the inventors to electromagnetic "law and order".

They were reported as having admitted quite freely that they themselves were operating illegally on the 144MHz amateur band, having moved there from the 27MHz CB band — where they had apparently also been operating illegally. The reason given for the move was that the 27MHz band had become "too crowded" with the influx of legal users, so they had simply obtained suitable 144MHz gear, and moved themselves to the less crowded amateur band!

I gather that this is by no means an isolated case. Amateur radio equipment is quite easily available, and there is a growing belief that the P and T department are turning a "blind eye" to illegal operation on the amateur bands. Small wonder that more and more young people are beginning to adopt the philosophy that "anything goes", and that rules, regulations and licences are only for suckers.

It seems to me that if this situation is allowed to continue, we are indeed going to end up with electromagnetic anarchy. And if we reach that state, it won't really matter whether the anarchy was planned, or just developed by default.

The time to prevent this from occurring is surely now, before things get any worse. The P and T department will have to crack down hard on illegal operators, particularly those occupying bands used by amateurs and other responsible users, even if this means devoting less short-term effort towards solving the 27MHz CB chaos. And of course the authorities will need the help of all responsible band users, to track down the offenders.

If there's one place in tomorrow's world where law and order are going to be essential, that place is surely the electromagnetic spectrum.

— Jamieson Rowe

Registered for posting as a periodical — Category B.
Printed by Magazine Printers Pty Ltd, of Regent Street, Sydney and Masterprint Pty Ltd of Dubbo, NSW, for Sungravure Pty Ltd, of Regent St, Sydney.

*Recommended and maximum price only.

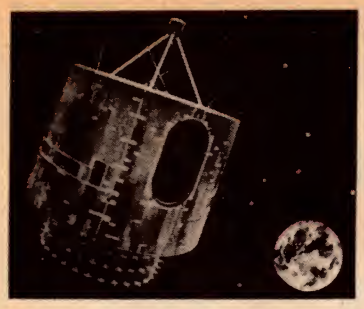
Editorial Office
57-59 Regent St, Sydney 2008
Phone 699 3622
Postal Address: PO Box 163, Beaconsfield 2014.

Advertising Offices
Sydney — 57-59 Regent St, Sydney 2008
Phone 699 3622
Representative: Narcisco Pimental.
Melbourne — 392 Little Collins St, Melbourne 3000. Phone 602 3033
Representative: Keith Watts.
Adelaide — Charles F. Brown & Associates Ltd, 168 Melbourne St, North Adelaide 5006
Representative: Tom Duffy, 267 4377.
Perth — 454 Murray Street, Perth 6000
Representative: Jack Hansen, 21 8217.

Subscriptions
Subscription Dept, John Fairfax & Sons Ltd, GPO Box 506, Sydney 2001.
Enquiries: Phone 20944, ext 2589.

Circulation Office
21 Morley Ave, Rosebery, Sydney 2018
Phone 663 3911.

Distribution
Distributed in NSW by Sungravure Pty Ltd, 57-59 Regent St, Sydney; in Victoria by Sungravure Pty Ltd, 392 Little Collins Street, Melbourne; in South Australia by Sungravure Pty Ltd, 101-105 Weymouth St, Adelaide; in Western Australia by Sungravure Pty Ltd, 454 Murray Street, Perth; in Queensland by Gordon and Gotch (A'asia) Ltd; in Tasmania by Ingle Distributors, 93 Macquarie St, Hobart; in New Zealand by Gordon and Gotch (NZ) Ltd, Adelaide Rd, Wellington.



News Highlights

Local industry urges satellite project

The question as to whether or not Australia should have a domestic satellite communications system is currently the subject of a series of public hearings being conducted a special government task force. The task force is composed of officers from the Postal and Telecommunications Department: the Departments of Finance, Defence, Transport and Health; the Australian Telecommunications Commission; and the Overseas Telecommunications Commission.

Open hearings began on February 2nd, and included such heavyweights as RCA, Ford Aerospace, Hughes Aircraft Corporation, Rockwell-Collins, California Microwave Inc, Thomson CSF, British Aerospace and Mitsubishi. The Australian Telecommunications Development Association (ATDA), representing local industry, has made a submission strongly in favour of the proposed satellite system.

According to task force chairman, Mr H. White (General Manager of OTC), the cost of the proposed system would be somewhere in the vicinity of $200 — $300 million, a figure that includes the cost of ground stations as well as the satellite. The emphasis will be on small ground stations costing between $3,000 and $5,000, a price well within the reach of individual graziers and remote station outposts.

Canada, for example, now has hundreds of small earth stations working from isolated communities as part of a domestic satellite system, Mr White said.

Two of Australia's nearest neighbours, New Zealand and Papua New Guinea, have also been invited to attend the hearings, and both countries had responded by sending representatives. Indonesia already has an operating domestic satellite system — this is a system installed by the Hughes Aircraft Company of California (USA), and ties together 120 million Indonesians on islands stretching from Sumatra to West Irian by telephone, telegraph, television and teletype.

Main aims of the proposed Australian system will be to cover the whole country with at least 4 television channels, and to provide a stepped-up capability in public telecommunications — both telephone and telex — and in "telemedicine". Full 2-way colour television could almost eliminate the need for doctors to go to remote places in the Australian outback, for example.

In its submission to the task force, the ATDA stressed that if the decision to go ahead with the satellite system was made, a large proportion of it should be developed and built in Australia.

The establishment of a national communications satellite provides the opportunity to build up our industry by allowing us to be involved to the maximum possible extent," the submission states.

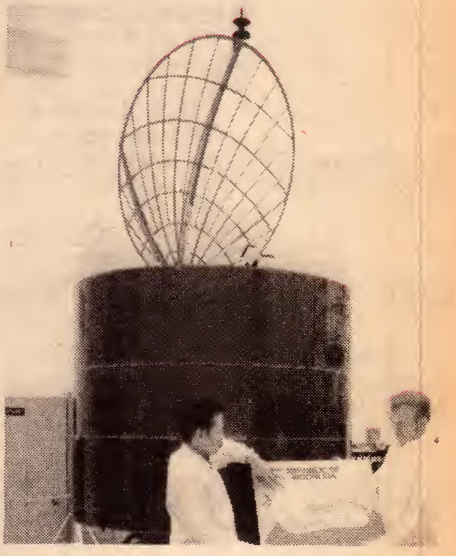
Canadian experience . . .

The ATDA cites Canadian experience in satellite communications which has resulted in Canada having the world's most powerful communications satellites. These satellites were the products of five years work by the Canadian Government and industry space scientists and engineers.

Canada has similar communications problems to Australia — large tracts of sparsely populated land and most of the population living in the cities. The Canadian decision to launch satellites was made with a firm commitment to involve local industry to the maximum possible extent, the aim being to develop the technology within the country so that it would be available in the future.

"The Australian telecommunications industry is equally capable of making a similar contribution," says the ATDA submission.

However, an Australian domestic satellite system is still some years off, even if a decision was made to go ahead now. In the meantime, it may be possible to upgrade telecommunications to some areas by renting transponders from one of the Intelsat satellites.



One of the two communications satellites built for Indonesia by Hughes Aircraft Corporation. It has the same capacity as Intelsat IV, but is half the size.

IREE convention and exhibition

The Institution of Radio and Electronics Engineers, Australia will be holding its next International Electronics Exhibition/Convention — IREECON '79 — in Sydney between 28th August and 31st August, 1979.

As has been the case in the past, it is anticipated that overseas and Australian engineers, scientists and technical personnel will be participating in discussions and lectures during the course of the exhibition, which will feature an extensive display of technical electronics equipment by leading worldwide and local manufacturers and distributors.

Enquiries regarding space at the 1979 exhibition should be directed to Heather Harriman, Institution of Radio and Electronics Engineers, 157 Gloucester St, Sydney NSW 2000.

During a recent business trip to the USA, Mr Paris Cockinos (left) of Paradio Electronics concluded an agreement with Daniel Meyer, President of Southwest Technical Products Corporation of San Antonio, Texas, to establish an Australian SWTP affiliate. To be called Southwest Technical Products Corporation (Australasia), the new company will be distributing SWTP products in Australia, New Zealand and south-east Asia. Among the new SWTP products released in recent months is the MF-68, a low cost dual minifloppy disc system for 6800 microcomputers.

Oil from coal — research shows promise

The first results obtained by CSIRO scientists with an engineering-scale rig for turning coal into oil by flash pyrolysis sustain the promise of earlier laboratory-scale experiments.

The two-storey high rig at the Division of Process Technology consumes 20kg of coal per hour. Finely powdered coal is swept into the reactor by a stream of gas where it is rapidly heated and decomposed (pyrolysed) into char, gases and tar.

On a population basis, Australia is richly endowed with coal, yet the supply of oil from our oil fields has already begun to dwindle. Making oil from coal is one way of stretching our oil reserves until renewable energy supplies can take over.

According to CSIRO work to date, the flash pyrolysis approach to oil production stands a good chance of becoming practicable in the Australian situation. In its simplest realization, a flash pyrolysis rig could be coupled to a large coal-fired power station, "creaming off" the valuable tars for petrol production and burning the residual hot char and gas for power generation.

Based on 25% tar from coal, first results indicate that a flash pyrolysis rig coupled to a 1000 megawatt power station should produce about 25,000 barrels of liquid fuel a day from Millmerran black coal. This is roughly 4% of Australia's current needs. The combined plant would consume about 17,000 tonnes of coal a day, some three times more than the power station would on its own.

AGR nuclear power stations for Britain

Amidst all the controversy over nuclear power, Britain has announced plans to build two new 1320 megawatt nuclear power stations at a cost of around $2146 million. Construction work will begin in 1980, with the stations expected to be operational by 1987.

The decision announced by the Secretary of State for Energy, Mr Tony Benn, follows a thorough review of the UK thermal reactor policy over the past 18 months. As a result, Mr Benn said it had been decided that Britain should discontinue work on its program of steam generating heavy water reactor (SGHWR) stations and instead build two more advanced gas-cooled reactor (AGR) stations

Mr Benn said the Central Electricity Generating Board and South of Scotland Electricity Board had been authorised to order one AGR station each as soon as possible. He also told Parliament that Britain planned to offer both the home electricity industry and other countries an alternative type of nuclear station based on the US-designed pressurised water reactor, known as PWR.

AWA to market teletext systems

Amalgamated Wireless Australasia Limited, the biggest Australian owned electronics group, has announced that it has arranged to market Jasmin Teletext in Australia.

Jasmin Electronics Limited, of the United Kingdom, is the world's largest and most experienced supplier of Teletext systems.

Teletext, derived from "text via television", is the generic name for a system which uses additional space capacity in the television transmission and reception system to provide a visual news and information service. In its ultimate development it can supply, on the press of a button, a wide range of news or other information.

Australian television stations are already sending out experimental teletext transmissions, although it has not yet come into commercial use.

A number of electronics manufacturers in Australia are experimenting with teletext. AWA, for instance, at its North Ryde laboratories, has fitted a standard AWA colour receiver with a built-in teletext decoding board and viewer keyboard. This experimental set is picking up with great clarity all of the Sydney test transmissions.

New CCTV camera "sees" in the dark

An RCA Type TC 1040H closed circuit television camera is focussed onto a group of trees standing in darkness on the edge of Dee Why lagoon, Sydney. The picture on the monitor at right shows the camera's ability to "see" in the dark. The TC 1040H is sold in Australia by AWA Redifussion, and is said to be suitable for both scientific and security work.

Smart loggers now start at $3,500. So do smart buyers.

The bare bones 9300 makes a great beginning for any data acquisition system. In fact, its English language programmability and alpha-numeric printer and display could be all your application requires. The ± 30,000 count digitizer handles J, K and T thermocouple types and voltage inputs from 1μV to 12V under program control. Other standard equipment includes autoranging, battery-protected clock, dual scan rates, and two monitor modes. All this, and we're still talking only **$3,500 for a ready-to-use, ten channel system.**

But System 9300 doesn't have to stop there. You can add up to 1040 channels, and options that alarm, average, display directly in engineering units and even save the program *indefinitely* in case of power failure. Monitor's exclusive "Mag-Check" feature verifies that data is properly written on IBM Compatible Magnetic tape. System 9300 also interfaces with a broad array of other peripherals.

Call (03) 836 6533 for application assistance. You'll be a smarter logger buyer for it.

THE DINDIMA GROUP PTY. LTD.
P.O.Box 113,
Balwyn, Vic. 3103

NEWS HIGHLIGHTS

Automatic flight planner

This new military flight planner — the Ferranti Autoplan 2081 system — provides operational and navigational data accurately and quickly and reduces the risk of error.

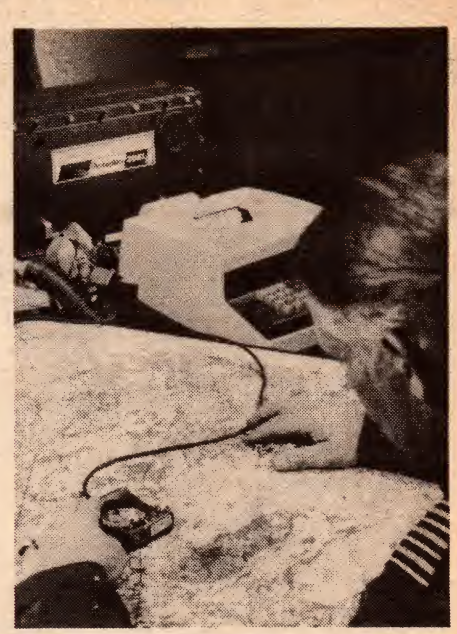
Shortly to enter service with Britain's Royal Air Force, it is rugged, inexpensive and operators need not be specially trained to use it. A sortie involving 20 turning points can be planned in as little as five munutes.

The Autoplan system consists of a map table with associated cursor (seen here), a computer, a fast output printer and a control panel. By entering the coordinates of any two datum points via a keyboard and placing the cursor over each one in sequence, the computer can calculate the scale projection and orientation of the map. Mission planning information, is then put into the computer through a "question and answer" procedure.

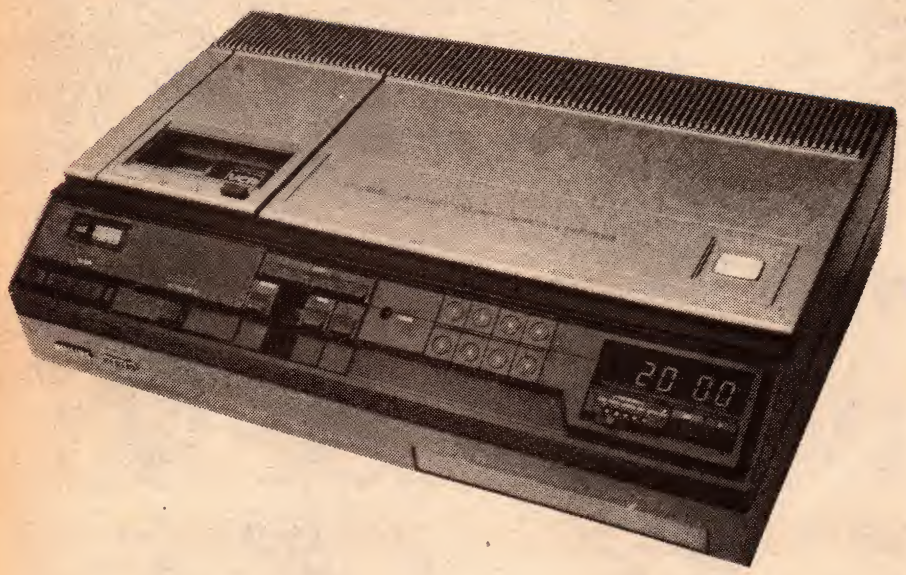
The cursor is then moved along the proposed route of the aircraft.

The computer then makes the necessary navigational calculations including the course to steer, time to turning points or target, fuel states etc, presenting the information on a paper strip that can be attached to the pilot's knee-pad or fed into an internal navigation system. A small portable data store is also available for use with the Autoplan 2081 that can be carried out to the aircraft and simply plugged into a digital navigation system.

The Autoplan 2081 system is manufactured by Inertial Systems Department, Ferranti Ltd. Silverknowes, Ferry Rd, Edinburgh, Scotland.



Philips launch long-play VCR



"It'll change the way you look at TV" — that's the advertising slogan now being used by Philips to promote its new long-play VCR, released in Australia last March. And, according to sales promotion manager Ian Dymock, the company means business. "We're putting as much money into launching this as we did for colour TV," says Dymock.

The new VCR, designated the N1700, is the first VCR designed primarily for the consumer market. It has a playing time of up to 2½ hours (depending on the tape used), is easy to operate, and will retail for around the $1000 mark.

Other features of the N1700 include a built-in pushbutton tuner, so that you can record one program while watching another, a three day electronic timer which enables the machine to automatically record a specific program whilst unattended, and the ability to record directly off an optional video camera.

A tape splicing kit and a head cleaning cassette are also being offered with the N1700.

Philips says its market research indicate that 75% of Australian homes will eventually have VCR facilities. The company sees the VCR as the next logical step in consumer entertainment equipment after colour television.

Tandy dealerships

Tandy Electronics' Australia Managing Director, Mr David Christopher, has announced plans to join with local retailers in towns of less than 25,000 population to form a network of Tandy Electronics Authorised Sales Centres throughout Australia.

The Authorised Sales Centres (ASC) concept will be patterned after the highly successful Tandy, USA and Canadian affiliate, Radio Shack program where a network of over 2,400 independent dealers have been licensed to supplement a chain of over 3,500 company owned electronic specialty stores.

Solar power for PNG trunk network

Work on equipment required to convert Papua New Guinea's entire trunk telecommunications network from battery power to solar power has just been commenced by Amalgamated Wireless (Australasia) Limited as part of a contract valued at $614,000.

Papua New Guinea is believed to be the first country in the world to take steps to power its entire trunk system with power from the sun. The contract will involve the installation of power cells at about 20 microwave repeater stations located on mountain tops throughout the country.

The solar power conversion will also be extended to some 200 outstations which at present use engine-powered generators to charge batteries.

Just how does a large company like Dick Smith Electronics keep track of some 3000 different stock lines? How do they know when to reorder stock, or what current stock levels are, or what to charge the customer? IBM's Peter O'Meara* tells how Dick Smith runs his very successful company — with a little help from a computer!

Dick Smith and his computer

Ask any electronic parts distributor what the biggest problem area of his business is and his response will probably be stock control.

By the time many companies in this competitive market are able to get an accurate fix on what quantities of a particular product are being sold or which items are the most popular, they may be facing at best, large stockpiles of some products or at worst, the threat of liquidation.

No company can afford to have large amounts of money tied up in slow moving stock. Where there is inadequate control of inventory, the situation can be swiftly and effectively righted with information — timely, accurate information on sales and usage, profit margins and order quantities — so that sales can be carefully monitored and potentially dangerous situations acted upon before they can reach the critical stage.

"By keeping branches and distributors properly advised on warehouse stock levels of all items we're ensuring our customers are kept happy and sales at all levels are maximised," Dick Smith of Dick Smith Electronics commented recently.

The Dick Smith Electronics Group is one company that is using a small business computer to get the information it needs to properly control stock, as well as handle sales analysis, billing and accounts receivable.

Only eight years ago Dick Smith was repairing car radios in his shop in the Sydney suburb of Neutral Bay. Today he owns and manages the Dick Smith Electronics Group, retailer and distributor of electronic parts and items through eight branches and 170 distributors around Australia.

A man with no formal qualifications in electronics or business management, but dedicated to the concept that "business should be fun", Dick Smith has guided his company's meteoric growth with his own brand of unorthodox and progressive management techniques and boundless enthusiasm.

Last year the group had a turnover of $7 million. This year that figure is expected to double to $12 to $14 million!

Dick Smith candidly asserts that his company simply could not have grown to its present size without a computer. The various reports it provides have enabled him to make sound business decisions based on up-to-the-minute information.

It allows him to know at any time exactly what quantity of a particular item is in stock at his warehouse in Artarmon, when the next shipment is expected, how usage varies from branch to branch, what the percentage profit on a given item is and a host of other pertinent facts.

How did the decision to install a computer come about?

It was in 1976 when the group established its distributor network that it recognised the need for a sophisticated invoicing, pricing and stock control procedure. "We have 3000 stock items and, until recently, we never really knew what quantities of each were being sold," Dick said. "One type of integrated circuit, for instance, might sell 20 times as many as another, but the same quantity of each would be reordered each time. And with that volume of stock items there was no way we could economically run a card system."

The goods sold by the group range in price from 2 cents to $1400 with four different sales tax rates and an average sale value of $30. This was causing major problems in sales accounting.

For these reasons, the company investigated proposals from a number of computer suppliers and finally decided to install an IBM System/32 using IBM's

Dick Smith with the IBM System/32 computer. The computer keeps track of invoicing, pricing and stock control at DSE.

Distribution Accounting programs. The increased control the system has given the group in its sales, inventory and accounting functions is "tremendous", according to Dick Smith.

Each day, operator Sandy Ferguson keys in stock as it arrives, updating the records to give current stock on hand. The system calculates, revises and issues prices (it handled all the pricing for the group's new catalog in this issue), produces invoices, statements and trial balance, calculates sales tax and provides detailed stock status and sales analysis and other reports.

At any time, Sandy might be interrupted to answer an inquiry from the warehouse or a customer on how many resistors, for instance, there are in stock, or when a shipment is expected, or what substitute items there are for a particular product. She simply presses the appropriate keyboard buttons to get the information she requires in seconds.

Dick commented, "If we get a Telex from the United States offering semiconductors at a special price, we can find out immediately what our usage and current stock of that item is and decide within minutes whether we should order or not. Previously we'd have had to go out to the warehouse and manually count the items then estimate sales — a totally inefficient and time-wasting method of doing business."

Ready access to accurate information on stock levels and usage has enabled the group to reduce its level of out of stock items from 15 per cent to 5 per cent, says Dick. As well, the information can be used to direct advertising and sales strategies. When excessive stocks of an item show up on a report, a direction can be given to offer it at a "special" price, thus quickly moving stock while noting reduced requirements for future purchasing.

The system is also producing preprinted order forms for branches and dealers for particular item classes. For example, the group carries 300 different manufacturing data and educational books. The book order form lists each book, showing quantity on hand and average monthly usage. Only the quantity required has to be filled in.

Previously, orders required descriptions and catalog numbers to be added. This was a time-consuming process and, without a full list of items, some were usually forgotten and had to be reordered.

When any item ordered by a customer is out of stock, the system prints the date the next shipment is expected to arrive on the invoice. "Without the computer it would be virtually impossible to provide this service," Dick said.

Another important area in which the system is proving invaluable to the group is the calculation of sales tax.

"In the past we manually calculated sales tax amounts on all invoiced goods," Dick explained. "Because these calculations can be very complex and involve extensive paperwork it's easy to get behind in payments. Now, however, within two days of the end of the month we know exactly what our sales tax commitment is!"

"For us, the IBM System/32 has been a great introduction to data processing," says Dick Smith. "Without it, the recent growth of my business would not have been possible."

* Peter O'Meara is NSW Manager, General Systems Division, IBM Australia Ltd, 100 Walker St, North Sydney, NSW.

The genius of George Westinghouse

Few inventors have had as much impact on the world as George Westinghouse. He invented the air brake that made possible the rapid development of the railroads; succeeded in launching AC power distribution against all odds; devised a method by which natural gas could be used on a large scale; and invented the automotive shock absorber.

by J. L. ELKHORNE

They called him "crazy George".

Young George Westinghouse surely represented the idea of the thin borderline between genius and insanity. Subject to violent fits of temper, he raged at any obstacle, and at times beat his head against the wall until it was bloody.

His fearsome reputation grew amongst his peers and one day a smaller boy made the mistake of calling George crazy to his face. The difference in size was as nothing to George — he beat the smaller boy to the ground. When George's father heard about this disgraceful conduct, he marched his wayward son to the woodshed for some traditional discipline. Firm muscles applied a stout switch, and with the first blow, it broke. Crying from fear and shame, George nonetheless pointed out that a leather strap hanging on the wall would be a better instrument, as it wouldn't break.

Such a statement made his father realize that normal punishment was not the answer for young George. In later years George Westinghouse appeared to be quiet and calm, to those who did not know him well — but only absolute self-control kept his temper even. That he was able to master his own nature is a tribute to a father's guidance and wisdom.

The elder Westinghouse owned an agricultural machine factory and thought George might keep out of trouble if he stayed busy. The plan worked only too well — George enjoyed spending so much time learning about the machinery that his schoolwork suffered. Finally, his father told him: "No more than two hours a day, here, and only if your grades are good."

Then one of George's teachers helped him with additional tutoring, but also recognised that George's active mind needed outside interests. He encouraged the lad to both study hard and continue to learn as much as he could about the factory.

In 1858, at twelve years of age, George became an employee in his father's business, earning two dollars a week. The senior Westinghouse saw to it that his son was treated as just another apprentice, rather than "the owner's son". The son began active work in the shop as a sweeper and machine wiper.

One sweltering, humid Saturday, Mr. Westinghouse had agreed to let his men have the afternoon off, when a rush order was received. The factory owner knew he had to keep his word, but he also knew he had a business to run. He felt it only fair to assign the preliminary work to the lowest ranking employee, even though that happened to be his son.

Young George had anticipated a fine afternoon of swimming and a picnic. Instead, he was sorely disappointed. He determined then that if he ever owned a factory, he would give his men every Saturday afternoon off, with full pay.

While he congratulated himself at such good intentions, an idea flashed into his mind. The many lengths of pipe he had to cut as threshing machine parts could be done quickly — he would use steam power to help him! All he had to do was chuck the pipe into a lathe driven from the engine and, as the pipe turned, apply the hacksaw. The results were as good as the concept. In less than an hour, the afternoon's work was done!

George fairly flew home to get his swimming suit. When his father saw the elated boy running through the yard, he found it hard to believe that the work had really been done. He had to go to the shop to see for himself.

George Westinghouse's first "invention" set the pattern for his life. His searching mind saw a wealth of invention, a new world of machine techniques that could make life easier for men.

His first real invention resulted from dissatisfaction with the reciprocating steam engines in his father's factory. He developed a design for a crude rotary engine, or turbine. Before he built a working model, however, the Civil War broke out and George enlisted in the army, with his parent's consent, at the age of seventeen.

In less than a year, he applied for and received a transfer to the Navy, since his mechanical training would be of greater use there. He had the opportunity to build a model of his rotary engine because, ironically, he spent the last two years of the war far from battle. In 1865 came the first real tragedy of his life — his elder brother, Albert, was killed in Louisiana.

On June 15 of that year, returning home on the train, George suddenly found himself pitched violently to the floor. Unhurt but curious, he left the coach to find out what had happened and spent the next two hours helping the train's crew get a derailed tender back onto the tracks. When he learned that such incidents happened all too frequently, his quick mind conceived a portable set of rails which could be placed so that the locomotive could pull the derailed car back onto the permanent rail.

Where George Westinghouse learned his trade — the factory of the elder Westinghouse in Schenectady, New York. The factory started in 1856.

Once home, he told his father of the rotary engine idea and got his father's assistance in filling out the patent application. In November, he received the patent award, the first of over 300 he would accrue during an active life.

George then attended Union College at his parent's wish, a plan they had had for Albert, but academic life was not to his liking. He found he could spend no time on inventions like the rerailer, and he further had to spend time on foreign languages, which were a complete mystery to him. At Christmas, the president of the college summoned George to an interview, admitted that he was brilliant, but said that he was not cut out for college life.

Further discussions with George's father indicated that continued study there would be inadvisable. The young man had determined that he wanted to be an inventor, a creator of new things. Now, to prove to himself and the rest of the world that he could succeed at something, he desperately spent all his spare time working on the rerailer.

Finally, George completed his design, incorporating such revolutionary concepts for the time as the use of cast steel over cast iron. His father advanced him enough money to finance patent costs, but declined to invest in the project. George found two backers, but not only did they demand that he assign the patent to a partnership they would form, they insisted he had to act as salesman for the new firm.

His first sale took less than ten minutes. Superintendent Towne of the Chicago, Burlington and Quincy Railroad said, "The diagrams did the selling." Towne became his first customer and a worthwhile friend.

Just as his career had begun with a train journey, so the young inventor now met the girl who would become his wife — in a railroad coach. He married her in August, 1867. Shortly after the wedding, George and his bride paid a friendly call at Superintendent Towne's home in Chicago. While wives became acquainted, the two men strolled into the study. The executive offered the young inventor a cigar and some advice.

"What railroading needs most, George, is a reliable system of braking."

"What's wrong with today's method, sir?" George asked.

"The human element. Time lag. A brakeman receives a signal from the engine and cranks a handwheel on his car."

George considered this and replied, "And the brakemen sometimes have to work several cars, don't they?"

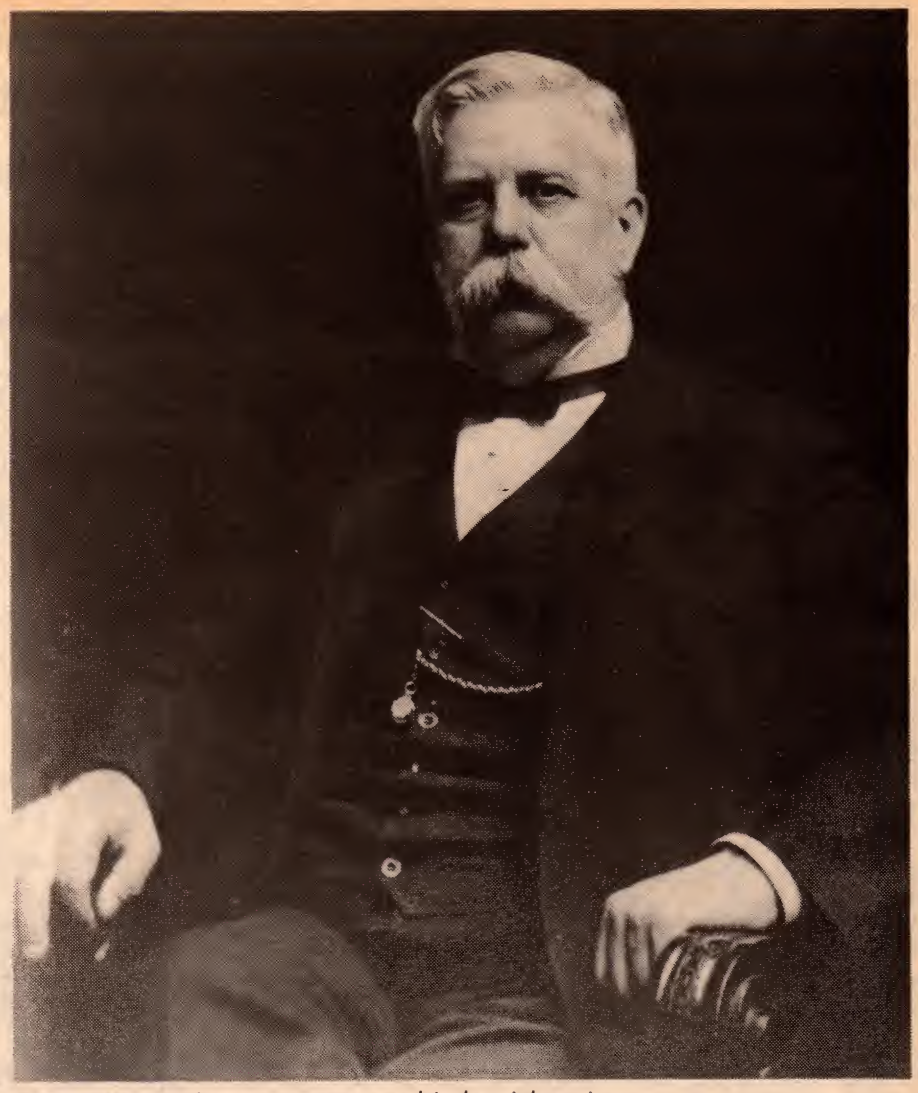
"Yes. It's a bad system. Too many men lose their lives that way. Wrecks still happen. If you could come up with a reliable mechanical system, you'd make a fortune, Westinghouse."

George smiled.

"No, I mean it," the older man said. "Good brakes would mean that we could run longer trains safely, our operating costs would be less, and corresponding freight rates would go down. Countless people would be indebted to you."

"I'll certainly think about it, Mr. Towne."

George did think about it. Plan after plan was imagined and discarded. Then another man approached Towne with a method. His technique was identical to one idea George had discarded. Experimental apparatus involving a complicated windlass mechanism was fitted to CB & Q's crack passenger train, and George Westinghouse received an invitation to the trial run. His rival's windlass broke the third time the brakes were applied.



George Westinghouse, inventor and industrial genius.

George worked on the problem with renewed energy, resolving to succeed where another had failed. Weeks went by in which George built a miniature train, weeks of constant experimentation and refitting. First he tried steam, readily available from the locomotive, but discovered that there was a time lag in running the steam from the engine to the last car. He also found that condensation could take place, rendering the system not only useless, but dangerous.

Then he hit on the idea of using compressed air. The pump to compress the air was steam-driven.

With success within his grasp — and a fortune to be made — George's business partners tried to increase the profits of their small firm by getting rid of George. They refused to even pay a license fee for the Westinghouse rerailer patent. George threatened to sue if they infringed. A few weeks later, the greedy villains argued amongst themselves; the ill-fated company went out of business.

At this point, the young husband needed work. A Pittsburgh foundry company offered to produce his rerailer, employ him as a salesman, and also pay a royalty for the patent rights. George left Marguerite, his wife, with his parents while he was on the road. In New York, he closed an order with the New York Central Railroad. He also tried to interest NYC in the compressed air braking system but received only bureaucratic excuses. The men who ordered the rerailer, which was tried and proven, didn't want to get involved.

Other railroad men he'd tried to interest in the air brake system had rejected it. Most could not understand the principle. Some few who thought there could be something in it were not willing to undertake the expense of fitting out a train with experimental apparatus.

George Westinghouse then did something daring. He personally confronted Commodore Vanderbilt, the hundred-million-dollar head of the New York Central, in his headquarters and demanded an interview. Such brash behaviour shocked the important executive but he was too amazed to refuse. The following day, when George explained his theory and showed the magnate the drawings, Vanderbilt numbered himself among those who refused to see the truth.

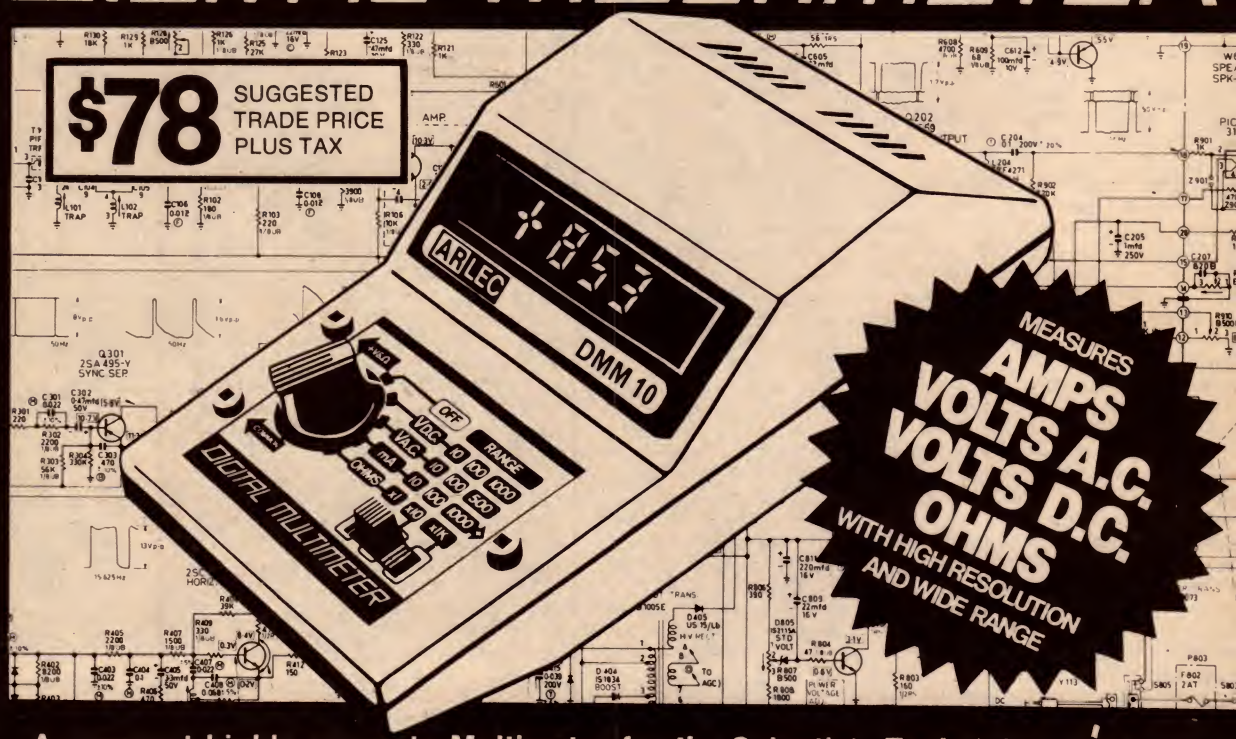
"You're trying to harness the wind and use it to stop a train. It can't work!"

The disappointed inventor was escorted from the office swiftly. Although he had failed with Vanderbilt, he still received a good commission on the NYC sale of rerailers, so when he returned to Pittsburgh he sent for Marguerite. One evening, while they were

Advance into the new era of precise electronic measurement

ARLEC DMM 10

DIGITAL MULTIMETER



A compact highly accurate Multimeter for the Scientist, Technician, Tradesman, Electrician and Advanced Hobbyist. ● SIMPLE 2 SWITCH OPERATION ● EASY READ DIGITAL DISPLAY ● 1% ACCURACY

Features:

- Large ⅜" (9.5mm) LED Numerals
- Automatic Decimal Point
- 3 Digit 0-999 Display
- Instantaneous Non-flashing Readout
- Zero Locked
- 7 MEGOHM Input Impedance.
- 12 Separate Measuring Ranges
- Over-range Indication
- Overload Protected
- 1% Accuracy

Supplied complete with:

- **RECHARGEABLE NI CAD BATTERIES**
- **SEC APPROVED PLUG-IN ADAPTOR/CHARGER**
- **CONNECTOR LEAD FOR CHARGING FROM AUTO BATTERY**
- **TEST PRODS**
- **OPERATING INSTRUCTIONS**
- **12 MONTH GUARANTEE**

DESIGNED & MANUFACTURED IN AUSTRALIA BY

SEE THEM AT YOUR LOCAL ELECTRONICS STORE OR THE A+R ELECTRONICS BRANCH IN YOUR STATE.

ARLEC
QUALITY PRODUCTS

A+R Electronics
A MEMBER OF THE A+R-SOANAR ELECTRONICS GROUP
30 Lexton Road, Box Hill, Vic., 3128, Australia.

VICTORIA: 89 0661
N.S.W.: 78 0281
STH. AUST: 51 6981
QUEENSLAND: 52 5421
WEST AUST: 81 5500
HONG KONG: (3) 89 127
TOKYO: 585 8025

The genius of George Westinghouse . . .

entertaining, George grumbled about his invention's lack of success. A friend, Ralph Baggaley, offered to put up the money to have the air brake apparatus built. The two men made contact with the Pennsylvania Railroad but time dragged on and the PRR failed to respond.

One day, a man came to their door.

"I'm W. W. Card, Superintendent of the Panhandle Railroad and I've heard about your brake system. I think we'll give it a try."

Within a week, Card had gotten permission for trials. "We'll place a train at your disposal," he told them, "but you'll have to bear the cost of installation. And if there's any damage, it's your responsibility."

A dangerous gamble, the pair thought, but if they succeeded, the risk would be worthwhile. They decided they could get by if they did most of the mechanical work themselves. When their task was completed, only ten dollars remained in their treasury. If the device failed, no one would give them another chance.

The test run of the modified train started with an air of celebration. A round of confident speeches preceded the event. Superintendent Card and a number of railroad officials boarded the passenger coaches. Westinghouse, however, rode in the locomotive with Dan Tate, the engineer.

As they pulled out of the Pittsburgh yards and opened the loco up, they anticipated only a routine test of the new apparatus. Still picking up speed, they rounded a bend to confront a sight which put Dan Tate's heart in his throat — a horse-drawn wagon straddled the tracks.

The sudden appearance of the train bearing down on them panicked the horses, who lurched forward, tossing the wagon driver onto the tracks. Without a second thought, Tate grasped the air brake lever and tugged it downward with all his strength. Pandemonium reigned amongst the officials in the passenger coaches, unaware of the problem in their path. The wheels screeched against rails hot in the sun and the train slid to a stop only a few feet from the dazed wagonman.

In seconds the railroad officials had rushed forward, demanding to know what had gone wrong. When they learned the truth, they declared that the brake had proved itself beyond question.

Three months later, in July 1869, the Westinghouse Air Brake Corporation was formed. Card and Baggaley numbered themselves amongst the board of directors. Twenty-three-year-old George Westinghouse was selected as president of the new company. Knowing that people prefer to be shown a new thing rather than told of it, he arranged for a train fitted with his air brake system to tour the country. This nationwide display generated great deal of public interest which, in turn, moved the more conservative railroad tycoons into adopting it.

The air brake was an excellent design. From the steam-driven pump in the locomotive, air pipes were rigged under each car. Flexibile couplings joined cars, and there was an automatic valve in the coupling to prevent the escape of compressed air when a car was detached from the train. A fitting from the main air line led to a piston affair under the car, which forced the brake shoes onto the wheels.

Once actuated, to release the brake, the engineer bled the air from the main pipe by means of a valve. Not much time passed before the fledgling company saw handsome profits coming in. Then George had an even better idea.

Instead of operating the brakes to stop the train, he reasoned, they should arrange the system so that the brakes were normally set, and use the compressed air system to hold the shoes away from the wheels. This created a fail-safe system. If an air hose broke, the shoe would slam into contact, preventing the car from becoming a rolling juggernaut.

The improved system found ready acceptance. Good as it was, though, it did not have the speed of control which would stop a fifty-car fast freight train with reliability and without cargo damage. George set about modifying the entire system, enlarging the air feedlines, improving the valves and greatly enhancing operating speed. Rather than talk to numerous railroad men about the latest improvement, he decided it would be more efficient to undertake the testing himself.

He had a fifty-car freight train fitted with the new system, at an expense of $200,000, incurring the wrath of Baggaley and the other company directors. Even though they called it the "most expensive train ride in history", they went along on the trial run. George placed a glass of water on the caboose floor and when the brakes were applied, the fifty-car fast freight came to a stop in two-and-a-half seconds, with so little jar that the glass of water did not spill. Further tests showed that the massive train could be stopped from 30kph in less than 60 metres.

W. W. Card witnessed this fabululous performance also; little time passed before the new, improved air brake had once again revolutionized railroading.

Ironically, now that trains could be longer and travel at increased speeds, new dangers presented themselves. The science of traffic control lagged behind mechanical progress. Signalling was still rudimentary. More, larger and faster trains meant more difficulties in despatching.

Westinghouse met the challenge with a complete electro-pneumatic signal system, the design reaching completion in 1880. As usual, there were no takers until someone had proved it. George was forced to organise a new company, the Union Switch and Signal Co., in 1881. He once again had to gamble, as growth was quite slow and the new plant required enormous capital. The Pennsylvania Railroad placed one of the first orders, which was a good sign, but years passed before this necessary safety concept gained full acceptance.

With the challenge of an interlocking signal system conquered — at least technologically — George looked for new horizons. Natural gas, one of nature's untapped wonders in that day, became the next endeavour. George, who knew next to nothing about geology, did not let that stop him. He reasoned that natural gas wells, with output in commercial quantities would be a wonderful new energy source for industry. Committing himself to the project completely, as he always did, George ordered a well dug on the grounds of "Solitude", his own estate in a Pittsburgh suburb. A walking beam engine running night and day jarred the quiet of his grand home and his neighbour's peace of mind.

Despite complaint, the well was brought in, one of the finest ever seen. Now that he had tapped nature's new secret, it remained to solve the problems of how best to handle it. Gas under pressure held great danger. But George designed a double-pipe conduit system, with safety valves and other safeguards.

By 1884, he had convinced the Pittsburgh City Council of the advantages of this new energy. He offered to provide gas free for certain public services, such as street lighting, and to provide the use of his pipeline to other gas producers at a nominal charge.

With another success behind him, Westinghouse reached out for another challenge and found himself involved in one of the strangest wars of the nineteenth century — the "battle of the currents".

He had seen the successful incandescent lamp of Thomas Edison, and he had heard rumours of a better electrical system than the direct current plants springing up throughout the country. DC distribution required sub-stations every mile or so, because of power losses in the transmission lines.

Even so, those adjacent to a powerhouse had about 130 volts available, which used up the lamps of that era all to soon. At the distant end of the line, however, the voltage was down to about 90 volts, giving electric illumination little better than candles. Despite its limitations, Edison had invested some two million dollars in DC power in New York City.

Westinghouse learned that infant theory of alternating current claimed much greater efficiency in transmission. Theoretical claims stood for little when weighed against the problems, though. A practical motor running on AC was needed and there were those who said it was impossible, "as the positive and negative would cancel each other". The new idea also came up against men who wished to protect their existing investment in DC plant and those who feared the unknown.

George Westinghouse held no fear. He bought the patent rights to an English invention, the Gaulard-Gibbs transformer. One of his engineers returned with an example; they found it was little more than a laboratory curiosity. George set about designing an efficient transformer himself — it took three weeks. At the end of 1885, he, his brother Herman, and a group of associates organised another new corporation, the Westinghouse Electric Company. Other business matters kept him occupied until the latter part of 1887, when news of a remarkable patent application reached him.

Then, in 1888, George Westinghouse, visionary industrialist, met Nikola Tesla, scientific genius and a discoverer himself of basic principles. Tesla, a Croatian, had received an excellent education in Europe as a mechanical engineer. He had developed a theory of alternating current distribution and use in 1882 — and built a two-phase motor to prove its efficiency — but could not interest staid Europeans in the concept.

In 1884, he decided to try his fortunes in the New World. After his arrival in New York, he worked for Thomas Edison but the two argued about AC and finally about a bonus Tesla had expected, and the two parted company. For over a year, Tesla worked at odd jobs and as a labourer. The United States was undergoing an economic crisis, suitable jobs were not plentiful, and besides, everyone knew that Edison had said Tesla was a bad 'un.

Fortunately, he met two men willing to take a chance on his ideas. They advanced some funds, he bought materials and built his working models. He filed for a patent on his system in October, 1887. Instead of the single patent he expected on what to him was a unified, coherent system, he received 40 patents covering basic apparatus. The key to his practical system resided in the concept of the "rotating magnetic field" which made the first AC motor possible.

Tesla pointed out that all generators and motors created and used alternating currents internally, but the commutator principle handled the currents external to the machines in a direct fashion. During school days, he had noted the sparking of the commutator as a sign of inefficiency — why not do away with it entirely? It remained for the genius of Tesla to conceive of the rotating field, which had no physical connection with the armature, but which would pull it along in synchronization.

Tesla's induction system made many things which are now taken for granted possible, such as good, cheap electric clocks, practical single and multi-phase motors, and true long haul distribution. He also patented the use of oil insulation, a number of basic principles of transformer construction, condensers, regulators, and other useful devices. Before his life's work had ended, he had over 700 patents to his credit.

Nikola Tesla had always known the value of his idea, but even he was surprised when Westinghouse appeared and said, "I will give you one million dollars for the use of your AC patents." Even in the face of that remarkable sum, he asked for a royalty based on the equipment produced. Westinghouse, knowing he was still getting a bargain, agreed.

Once the word had spread that Westinghouse and Tesla had joined forces, the "battle of the currents" began in earnest. The direct current faction, fearing for their investment, set about to defeat the combine. AC was too dangerous, they claimed. A propaganda war resulted.

Edison proceeded to electrocute cats and dogs with AC on Sunday afternoons, for the edification of the public. One of his confederates lost his grip on a dog during one demonstration and himself fell on the plates, which were fed by a 1-kilovolt generator. While he did not die, the experience remained with him. He described the sensation as that of "an immense rough file thrust through the quivering fibres of the body."

Since Edison was paying twenty-five cents a head for the animal victims, it is said the pet population of West Orange, N.J. was nearly decimated.

A "former" laboratory assistant of Edison's, H.P. Brown, succeeded in lobbying for a bill to provide for the use of electricity as a means of capital punishment in New York State. For a time, it looked as though "To Westinghouse" would be the new slang term for execution. Brown demonstrated, on dogs, that electrocution by AC "was instantaneous, painless, humane and left no disfiguring marks." To add insult to injury, when the bill was passed, Brown, by now a consultant to the state, authorized the purchase of three Westinghouse generators to be installed at Sing Sing Prison. When Westinghouse learned the intended use of his equipment, he protested — only to be told that DC generators could hardly provide the high voltages necessary for such work.

Edison wrote: "Just as certain as death, Westinghouse will kill a customer within six months after he puts in a system of any size. He has got a new thing and it will require a great deal of experimenting to get it working practically. It will never be free from danger."

He also published an article in which he stated: "I have not failed to seek practical demonstration . . . I have taken life — not human life — in the belief that the end justified the means."

Yet, some authorities claimed that workmen on DC systems throughout the country were fatally injured at the rate of a man a month. In an interview, Westinghouse said of thirty distribution accidents he had studied, sixteen came from DC and none where his equipment was in use.

On August 6, 1890, convicted wife murderer William Kemmler made history as the first man to be executed by electrocution. Twice! In a secret ceremony, the condemned man was strapped into the chair. The switch was thrown but Kemmler did not receive a lethal shock. He was taken to his cell, adjustments were made, and the execution repeated. The New York Times called it "an awful spectacle, much worse than hanging".

Westinghouse countered this setback by winning the contract to light the New York World's Fair of 1893, the Columbian Exposition. Countless thousands of people marvelled at the new system and the equipment on exhibition in the Manufacturers' Building.

Nikola Tesla, riding on the crest of an inventive wave which lasted half a century, had developed startling new concepts in alternating current. In his own exhibition, he nightly demonstrated that AC per se was not dangerous. After an hour of scientific "magic" with high frequency currents, he capped his performance by passing one million volts "through" his body to melt a copper disc by the touch of his outstretched hand.

Impressed by this dynamic duo, public opinion went in their favour. By 1895, the two had won and completed the contract for the Niagara Falls power station. The original two-phase generators were later rebuilt for three-phase operation and were still in use as late as 1959. The initial 15,000 horsepower developed at Niagara Falls could not meet the demands of energy-hungry industry and seven more units were installed.

Cheap, plentiful electric power put aluminium refining on a sound basis and enabled a giant artificial abrasive industry to be realized. In a year, the city of Buffalo, New York saw its first AC transmission line. Edison's General Electric Company had long since capitulated and purchased a licensing agreement to manufacture AC apparatus.

Westinghouse, in his eagerness to put the nation on an alternating current basis, had attracted a large amount of necessary, outside capital. He had had to seek enormous loans and still needed money. Pittsburgh bankers, not satisfied with his handling of the business — he "spent too much on research" — demanded a general manager of their own choosing. Westinghouse told them what they could do with their manager; the loan was refused. He then managed to secure a loan from New York banking interests with no such provisos. During this struggle, the board of directors refused to honour the royalty agreement with Tesla and ordered Westinghouse to find a way out.

The entrepreneur laid the problem before the inventor who had become his friend. Tesla knew the success of his AC system lay in getting it into operation on a vast scale. More interested in scientific and engineering accomplishments than in material wealth, he tore up the contract. The claim is made, but cannot be substantiated, that the piece of paper could have been worth 12 million dollars.

In 1938, Tesla gave a speech in which he said that "George Westinghouse was, in my opinion, the only man on this globe who could take my alternating-current system under the circumstances then existing and win the battle against prejudice and money power. He was a pioneer of imposing stature, one of the world's true noblemen of whom America may well be proud and to whom humanity owes an immense debt of gratitude."

This debt of gratitude gained bitter payment. In 1907, America suffered another financial crisis. An independent company like Westinghouse Electric found itself surrounded by the wolves who stood to profit by its decline. They brought pressure to bear to have the loans foreclosed. Westinghouse took steps to protect his investors, putting the company into receivership and working with bankers to reorganize the firm. A new chairman of the board was appointed, a man who opposed Westinghouse's "radical" policies like the treatment of his workers, and his strong commitment to research.

In 1909, although the company had become sound and solvent once again, Westinghouse was forced into retirement. The firm he had given birth to rejected him.

George Westinghouse, in his lifetime, sponsored many unusual ideas about the handling of his employees. He initiated planned communities for the families of his workers. The model town, Wilmerding, Pennsylvania, was the prime example. Westinghouse initiated a plan for worker's compensation for sickness or injury, and medical facilities were provided for his men and their families.

Harking back to his childhood decision, he had started a policy of a half-day off with pay on Saturday and he kept employees on the payroll at times when the board of directors would have laid them off, leaving them to the mercy of creditors. Yet he abhorred the idea of charity.

Though Westinghouse had relinquished control of Westinghouse Electric, he still reigned at the Air Brake Company. In his sixties, he could not accept the idea of idleness. Ironically, another idea came to him at this time by being again thrown out of a seat. The "horseless carriage" he'd bought was poorly sprung. So, in one afternoon, he invented the shock absorber, making yet another use of compressed air. In 1910, the Westinghouse Air Spring Company was organized, its products becoming basic to all automobiles.

On March 12, 1914, the man who had made so many changes in the world died in his sleep. He was sixty-eight. His final resting place is Arlington National Cemetery.

Forum

Conducted by Neville Williams

Why doesn't E.A. do this, or that?

Perhaps it's a sign of healthy interest that we receive frequent letters suggesting that we follow this or that course of action. While we acknowledge most such letters at a personal level, or briefly elsewhere in the magazine, it does help occasionally to discuss suggestions at greater length to indicate the reasons for our actions and attitudes.

In discussing why we think as we do, one has to be careful not to be seen to be preaching, or to be taking the position that we've thought of everything; that our judgement is beyond question. Whatever opinions we hold about ourselves, as a team, that isn't one of them!

On the other hand, working as a team representing different age groups and different backgrounds, our ideas do undergo a fair amount of internal challenge and debate, before finding expression in the magazine.

These remarks are prompted by a letter from a reader in New Lambton, NSW. The writer asks certain questions, which we answer, but they open up areas worthy of wider discussion.

Dear Sir,

Until recently, I have been buying five electronics magazines but I have discontinued the practice. I now buy only two magazines each month and "Electronics Australia" is one of them.

However, I would like to suggest the following with regard to the magazine:

Why not gather all the projects presented over the last few issues (say since 1975) into separate subjects, e.g. computers, amateur radio, audio, etc. Make up each into a separate volume and offer each one as a book of projects?

This would solve one of the problems which many readers, from their letters appear to have: lack of storage space for their copies of E.A.

I would also like to mention a matter which disturbs me, considering that four of your staff members listed hold amateur callsigns. While I realise that there is quite a few CBers around, why do they receive so much attention compared to amateurs (one of whom called himself Guigliemo Marconi)? After all, if it wasn't for AR, where would CBers be?

While on the subject of CB, I would like to ask why, in the list of CB operating conventions, published in March and November 1977, 10-14 is listed as meaning "what is the correct time?" It is internationally accepted that 10-36 is the code for this.

Again, I would like to ask when there is going to be some more amateur projects? How about a decent design for an all-band transmitter, transceiver, or even a receiver?

So how about the amateur gear? Ever heard the calls VK2XV, VK2ZLO/T, VK2ZPW or VK2AZN/T?

P.F. (New Lambton).

Taking the points in order, the subject of circuit books is very much before us at the moment and, in fact, we have just completed the production of "Projects & Circuits No. 2". It has highlighted some of the problems involved.

Not the least of these has to do with the rapid turnover of components and the associated circuitry. Years ago we could describe circuits, knowing that they would be current for a long time.

But, nowadays, key components appear on the market, only to be superseded within a few months by smaller or better or cheaper equivalents. That puts us in a quandary, as it does the stockists; if we fail to respond to the new product, we are seen as conservative or dilatory; if we do respond, we accelerate the obsolesence of the earlier design — which is probably doomed anyway!

The end result is that, when we look back over projects for the last few years, with the idea of segregating them into subject themes, we discover a variety of reasons why certain of them should not be resurrected, in fairness both to hobbyists and parts suppliers. For sure, the projects would still look all right, dressed up between glossy covers — but in the long term, they could well lead to recriminations.

We wince, at times when we see books on sale in Australia, reprinted from overseas sources, featuring components that would be near impossible to get; circuits designed for 117V mains; and gadgets which are totally inappropriate or illegal in this country.

What we have to do, therefore, is to collate the available material into handbooks which are likely to be viable in their own right. It is a fairly costly exercise and, if a book fails to sell in sufficient numbers, it becomes a big red entry in our ledger.

Viability is therefore the basic criterion which has to be satisfied and, while books of certain hand-picked reprint material do find an adequate market, we could not be optimistic about books which proceed from the premise of solving a filing problem.

Now to the matter of the licensed amateurs on our technical staff, and the attention paid to CB radio during the past year.

It may sound rather brutal to say this but there is really no connection between these two subjects, apart from the emotive one. It is true that some members of our staff have an interest in amateur radio — along with computers, hifi systems, electronic organs, model trains, old-time films, photography, travel, vintage cars and a variety of other things too numerous to mention.

The degree to which any such interests penetrate the pages of the magazine — if at all — is determined primarily by the expectation of electronics orientated readers, who reveal their majority preference in the most eloquently possible way: buying or rejecting the magazine on the news stands. Not surprisingly, advertising revenue tends to follow readership and the two sources, between them, pay the bills.

If an editor ignores what is topical and neglects the current interest of readers and advertisers, pretty soon he doesn't have a magazine to argue about!

Looking back, FM broadcasting was very much in the news during 1974, with 1975 the year of colour television. 1976 was notable for a tremendous emphasis on hifi/stereo, with readers clamouring for information and advertisers wanting access to those readers. But interest in hifi peaked and died in December of that year.

Then last year, out of the blue, came CB. For sure, it was a carryover from events in America, and encouraged from Japan. But the end result was a tremendous upsurge of interest in Australia — shared by the public, would-be CBers, novice amateurs and, of course, by potential suppliers. So intense was the interest that it led to the creation of several new publications, and it would have been commercially stupid for E.A. to pretend that CB didn't exist, particularly after it was legalised.

For sure, there were emotional overtones, if only because personal at-

titudes to CB amongst our own staff were just about as diverse as were the attitudes in the ranks of amateurs generally.

The weakness of P.F's argument is revealed in his use of the phrase "while there are quite a few CBers around. . ."

There certainly are: maybe ten to twenty times as many CBers as there are amateurs! Purely on this basis, they would rate ten or twenty times the space allocation.

They don't get it, of course. Perhaps this indicates that those amateur callsigns in our staff list may be having an effect, after all!

P.F. will doubtless be happy to know that interest in CB radio has already tapered off sharply in Australia, as in America, with plenty of companies caught with more stocks than they can sell, at least in the short term.

Responding to the changing attitudes, we have already moved the CB section further back in the magazine, grouping it with a somewhat enlarged amateur radio section and a more generously displayed Shortwave Scene. The result is a more definable "radio" segment, for readers having that kind of interest and for advertisers seeking to market transceivers and receivers of one kind and another.

Superficially, it may appear that we have thrust together interests which have no common ground — only disputed ground; but this is scarcely the case.

Commercially, at least, quite a number of firms are marketing both amateur and CB transceivers and a variety of accessories. It makes sense in terms of service back-up, while initiatives generated by the CB euphoria in mid '77 have carried over into the other fields.

What remains now is the need for adjustment at a personal and community level.

P.F. asks the question: "After all, if it wasn't for AR, where would CBers be?"

I may have missed something but my impulsive response to the question would be "Exactly where they already are!" If some amateurs have co-operated with CBers, a lot of others have sought to frustrate them and the influences may well have balanced out.

It may be much more to the point to reverse the sense of the question and ask: "Where will amateurs be without CBers?"

What the amateurs need right now is numbers; more genuine recruits to their ranks, who will increase their community muscle. Like it or not, the most likely source of budding amateurs is the present large number of disillusioned CBers, who want to get out of the 27MHz rat-race into a band like 144MHz, where commonsense reigns.

In Australia, as in America, the number of amateurs is on the increase. In Britain, where there are no disillusioned CBers, the number of amateurs would appear to be falling.

FORUM — Continued

It may well be true that Marconi saw himself as an amateur, and it is certainly true that amateurs have held a traditional and rather privileged position in respect to world spectrum planning. But it is also a fact that an increasing number of nations hold to no such tradition, and are ready to question the right of amateurs to any spectrum space at all.

Looking ahead to 1979, some senior American amateurs are reportedly apprehensive that the movement could lose most if not all rights in the HF spectrum, at least.

One report from the USA, not calculated to improve relations between amateurs and CBers is to the effect that some CBers are contemplating a petition to Congress to reclassify them as amateurs and give them access to all the frequencies and privileges currently available. To make this possible, the USA should withdraw, if necessary, from any relevant international agreement.

Impossible, say some; the FCC would never buy that idea, having in mind the tradition and number of amateurs in their ranks.

Others are not so sure, pointing to the fact that Congress holds the strings of the FCC purse and that Congress could be quite sensitive to the opinions of a reported five million voters.

Hopefully, from the amateur viewpoint, it won't happen that way but, as I said earlier, it does underline the necessity for greater numbers and more community muscle.

Right now, amateurs in Australia have a unique opportunity to add significantly to their ranks via the CB and Novice Licence route and, in the interests of their own cause, they would be wise to do all in their power to convert rather than antagonise.

P.F. also mentions an apparent inconsistency in our listing of the "10" code.

There's no way I'm going to get uptight about that!

The 10-code was a form of posturing by the early CBers and was adapted from American law enforcement agencies, as much as anything of the television kind. The practice has since become a massive and ridiculous exercise in conformity.

In case you hadn't noticed it, CBers have also provided themselves with the 13-code, as a means of trading insults!

One CB handbook defines the 10-code as abbreviations used by CBers to minimise the use of air time.

What a load of garbage!

Since when is "home twenty" an abbreviation of "home" or "address"? Or "a big 10-4 on that one" an abbreviation of "yes" or "that's right"?

In fact to compare the 10-code listings in various CB handbooks is to discover that there are many inconsistencies, with the confusion between 10-14 and 10-36 being just one of them.

Personally, if I ever find myself on a CB channel, without a clock in sight, and if I need the information, I'll most surely ask:"what's the time?"

Hopefully, the odd listener will still be able to understand the question in that form!

Finally, there's the vexed question of projects for amateurs, with particular emphasis on a design for an all-band transceiver, transmitter, or receiver.

Twenty years ago, and more, we were very active in this area, at a time when:

- The construction of even ambitious amateur projects was relatively straightforward;
- The expectation and attitude of amateurs was in line with practical "home brew" equipment;
- The parts supply position was relatively stable and predictable.

The position, since then, has changed completely.

An enormous amount of research and development has been poured into commercial receivers and transmitters, funded by sources as diverse as CB radio and the space program. The result is that amateurs world-wide can buy any number of commercial units at a price which is modest, considering their performance.

Such units have become the amateur "norm", or point of reference. With relatively few exceptions, amateurs nowadays aspire to own such equipment or, presumably, its close equivalent.

If we were to set a member of our staff to the task of designing, developing and hand-producing a project to meet this kind of requirement, it would involve months of work, far more exacting and tedious than other projects we are currently coping with. It would be a nightmare to present in the magazine, heavily dependant on hardware, and highly dubious as a kit investment for a stockist. In fact, it is highly likely that the cost of buying, stocking, packaging and selling the parts would be greater than the cost of assembling the equivalent components into a complete unit on an Asian, automated production line. How many amateurs would still want to build, in the face of this?

The plain fact is that amateur practice is following the trend of engineering practice generally: specialists produce modules and the user contrives or engineers systems around them, adapting, solving interfacing problems and providing peripheral bits and pieces.

Looking ahead, we see that as the most likely and continuing area for future amateur projects.

P.F's final sentence seems to carry the implication that members of our staff hold callsigns but never use them. I can assure him that at least three of those callsigns are in current use, reinforced by our regular amateur correspondent Pierce Healy, VK2APQ.

Modern expertise and computer technology have created a fine piece of equipment.

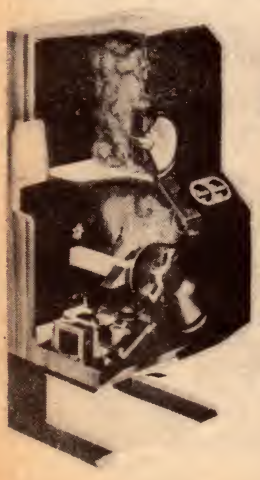
The NEW B&W DM7

The DM7 complements a remarkable range of monitor loudspeakers from B & W.

The DM7 is the first of a new loudspeaker family reflecting [illegible] programme. It is a compact 2-way system employing entirely new drive units in an enclosure engineered to exceptionally high standards. Many advances have been incorporated to reveal new horizons in loudspeaker performance, making possible a standard of musical reproduction unequalled in an enclosure of this size. The DM7 gives almost perfect amplitude linearity throughout the entire audio spectrum, and produces phase-coherent sound within a broad listening area. The drive units are purpose-designed and manufactured entirely in our own factory, employing new technology in order to achieve incredibly low distortion levels — typically less than 1% THD from 30Hz to 200Hz and less than 0.5% above that frequency. Another new feature in the DM7 is a variable energy control giving four frequency weightings — different to those obtainable from the control unit — to accommodate widely varying room acoustics.

Hear the B & W DM7 — you may well agree that this is the finest small speaker in the world today. Guaranteed for 5 years.

The B & W DM6 is Britain's first linear phase loudspeaker. A dynamic system that will reproduce sound with transient accuracy usually achieved only by the very best electrostatic designs.



The DM4 is a 3-unit monitor loudspeaker system that produces high quality results from an incredibly small cabinet (20.8 litres) making it perfect for home or small studio use where space is at a minimum.

Only 28" x 9" x 9½". Despite its compact size, DM5 speakers can be rated as a system of very high quality. The design philosophy of John Bowers — "To design loudspeakers that reproduce in your home sound as you would hear in the concert hall".

NSW: CONVOY SOUND WOOLLOOMOOLOO SHOWROOM 357 2444; INSTROL HI-FI PTY.LTD. 29 7290; PARK ST. HI-FI STEREO CENTRE 26 2798; MILVERSON PTY.LTD. (CHATSWOOD) 412 2122 (PARRAMATTA) 635 3588; RIVERINA HI-FI 938 2663/4; UNITED RADIO DISTRIBUTORS PTY.LTD. 232 3718; ARROW ELECTRONICS 29 8580; RUSSIN HI-FI 799 2421; PITMAN'S RADIO & TV (WAGGA) 25 2155; ALBURY AUDIO CENTRE 25 1712; LEISURE SOUND (CHATSWOOD) 411 4944; WROTH CENTRE HI-FI (BATHURST) 31 2088; BYRON BAY TV & SOUND CENTRE 85 6762; SINGLETON HIGH FIDELITY CONSULTANTS 72 2270; HI-FI JUNCTION 389 4000; **ACT:** DURATONE 82 1388; **VIC:** SHEPPARTON HI-FI 21 9006; ENCEL ELECTRONICS PTY.LTD. 42 3761; SOUND SPECTRUM (GEELONG) 9 6616; SOUTHERN SOUND (CITY) 67 7869 (MOORABBIN) 97 7245; TIVOLI HI-FI 81 2872; THE SOUND CRAFTSMAN 509 2444; BUY RITE ELECTRIX 426200; NATSOUND 678158; INSTROL HI-FI 675831; INSTROL HI-FI (FRANKSTON) 783 7535; **QLD.** JOHN GIPPS SOUND 36 0080; PREMIER SOUND (NTH. ROCKHAMPTON) 27 4004; TARGA ELECTRONICS (CAIRNS) 53 2715; RUSS ADAM (TOWNSVILLE) 71 5618; **TAS.** BEL CANTO (HOBART) 34 2008; UNITED ELECTRONICS (LAUNCESTON) 318528; AUDIO SERVICES (BURNIE) 31 2390; **WEST. AUST.** TECHNICAL SERVICES PTY.LTD. 31 5455; THE GINZA 61 7444; **STH. AUST.** BLACKWOOD SOUND CENTRE 278 1281; INSTROL HI-FI 2237622; SOUND SPECTRUM 2232181.

Sole Australian agent:

Convoy INTERNATIONAL

4 Dowling Street, Sydney 2001. Phone: 358 2088.

'LINEAR PHASE' LOUDSPEAKERS — THERE WAS A DIFFERENCE, BUT . . .

One of the "in" features in loudspeaker system design, these days, is a physical shape which will ensure a so-called "linear phase" relationship between the individual drivers. What is not so clear is whether the idea has real practical value, having in mind normal listening conditions and the nature of virtually all available program material.

by NEVILLE WILLIAMS

Hopefully without being tedious, it may be wise to explain the principle, for the sake of those who are not immediately aware of it.

The majority of modern hifi loudspeaker systems employ two or more transducers; this on the assumption that it is easier to design and produce special "woofers", "squawkers" and "tweeters" to handle the bass, middle and high frequencies respectively, than it is to produce a single wide-range transducer of equal merit. (A multiple driver system also happens to be more marketable!)

Multiple transducers need to be fed through a suitable frequency dividing network and it was appreciated quite early that one effect of such a network is to modify the phase of the signals being radiated by the respective transducers. The amount of phase difference tends to increase with the complexity of the network and it is not unusual for designers to specify that the connections to the mid-range drivers in particular be reversed by way of compensation.

Subsequently, engineers began to speculate that there was more to loudspeaker phase relationship than merely ensuring that all cones tended to move in step. What was the point in so doing if the distance between the respective cones and the listeners' ears was notably different? Frequency components which were coincident in the electrical signal would reach the listeners' ears at different times because of the different path lengths from the loudspeakers.

Accordingly, a whole array of new-look systems arrived from system manufacturers, variously shaped but all seeking the same objective: to get the path length from the respective cones substantially the same, relative to the ears of a person seated in the most likely listening position.

This, plus close attention to the crossover network, purportedly yielded a characteristic described as "linear phase", or by some other such term.

To lend weight to the contention, a common demonstration procedure was to synthesise an accurate square wave and display it on a CRO screen. Then some of the components of the square wave would be delayed in time, without changing their amplitude, and attention drawn to the drastic effect this had on the original square-wave shape — in visual sense.

Many would not accept the demonstration as valid, claiming that there is no essential relationship between a visual pattern on a CRO screen and a sound pressure wave at the ear. They maintain that the ear tends to break up some pressure waves into their component frequencies, responding independently to those frequencies, irrespective of phase.

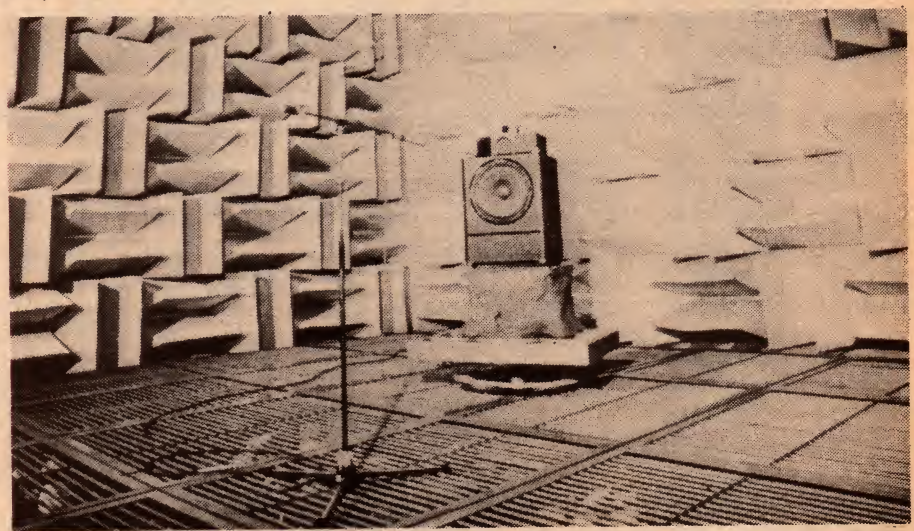
Doubts were expressed also about the ultimate efficacy of manipulating the planes of the driver cones. How does one reconcile the "plane" of (typically) three cones, of quite different diameter and depth, seperated in space with only an assumed relationship to the listeners' ears?

And what about those prestige omni-directional loudspeaker systems which go to the other extreme, deliberately bouncing signals off adjacent walls, and seemingly scattering rather than featuring phase?

Against a background of this kind of controversy, I was very interested to share in a demonstration of the linear phase concept in an anechoic chamber at Matsushita in Osaka, Japan. Matsushita are, of course, keen proponents of the idea, as evidenced by the configuration of current model Technics loudspeaker systems.

As a starting point, a prototype Technics linear phase loudspeaker was set up in the anechoic chamber, facing a high quality microphone a couple of meters away. A square wave signal was fed to the loudspeaker and, standing in the control room, we were able to see the corresponding signal, picked up by the microphone and displayed on a CRO. It wasn't by any means a perfect rectangle but the generally square configuration could not be denied.

Next, one of the engineers went into the chamber and while we watched, slid the tweeter forward from its optimum position, towards conventional



A Technics RB-7000A 3-way loudspeaker system, set up in an anechoic chamber at Osaka, to demonstrate its linear phase characteristics. Shifting the tweeter relative to the other drivers made an audible as well as a visual difference to the sound envelope of a square wave. To what extent program material would be affected, heard under ordinary stereo listening conditions, is another matter.

"Marantz let me build the speakers I've always wanted to build."

Ed May, Vice President Speaker Engineering for Marantz

Over the past twenty years Ed May has firmly established himself as one of the industry's top experts on speaker systems. Formerly the manager of speaker engineering for JBL, Mr. May has personally been responsible for many of the advances in speaker technology. As the new director of Marantz Speaker Development we asked him to comment on the new Marantz Speaker line.

"Since joining Marantz I've never been turned down on anything I've wanted to do to improve quality. When it comes to quality, cost is no object."

"Our new Marantz speaker line is one of the top lines in the industry. The reproduction capability of our speakers can equal or out perform speakers that cost two to three times the price."

"We don't follow fads. We stay away from frivolous things that only increase the price tag without increasing performance."

"Our toughest critics are ourselves. Many of the things we measure and test for are seldom encountered in the field."

"My philosophy is to build the speaker so it reproduces all frequencies as smooth, as flat as possible in all angles of radiation. No matter where you sit you hear exactly the same sound."

"I'm very proud of our new Marantz speaker line. It's what I've always wanted to build. My hat is off to Marantz for letting me do it."

marantz.®
We sound better.

For Brochures contact — **Marantz Company, PO Box 604, Brookvale, NSW 2100**

Marantz Company is a trading division of Superscope (Australasia) Pty Ltd

vertical alignment with the front pads of the main bass and middle drivers. Looking at the CRO pattern, we saw it take on a distinct triangular shape, occasioned by the changed phase relationship.

But wait: that was fine at what might have been a selected frequency. How would the observation stand up at a variety of other frequencies?

We were duly invited to pick other frequencies in the middle register and see for ourselves—which we did by slowly rotating the dial of the audio generator. While the waveshape did buckle and bend a bit, the point was made: the predetermined linear phase position remained more or less the optimum one, irrespective of frequency.

Okay; but could one hear the difference?

To answer this, we were conducted inside the anechoic chamber and invited to listen critically to a square wave while the tweeter was once again slid to and fro. There could be no doubting it: the nature of the sound did change; quite perceptibly so, in fact.

Still inclined to "stir", we tried something else — leaving the tweeter locked at its optimum position and bending our knees to get below the line of sound, this modifying our relative relationship to the two drivers. The nature of the sound went through similar changes to the previous observation.

Not having telescopic legs, we were unable to get above the line of sound but reckoned that the same effect would be observed!

Not to be denied, the Japanese took us outside the chamber, once again, set up the speaker and microphone for optimum results and then moved the microphone around in the area where a listeners' ears could reasonably be expected to be — being neither a dwarf on a cushion, nor a 7-footer on a high stool!

Looking on a CRO pattern, we had to admit: "you win; you've made your point!" Within the likely listening zone, the linear phase position for the tweeter was the best average choice for a recognisable square wave.

Because there was so much else to see and do, we simply had to walk away from the demonstration and from any more debate on the subject. But I did tuck away two or three reservations for future cogitation:

1. While the demonstration supported the basic concept of linear phase, it was a rather academic exercise. Would it have been anything like as convincing in an ordinary listening room, with the direct signal overlaid with echoes?

2. Would there not be a further departure from the demonstrated condition when listening to a stereo system, with both speakers contributing to sound from the central image area?

3. While admitting that the sound did change under the strict demonstration conditions, there was no way in which the word "change" could be interpreted into "right" or "wrong". Nor was there any indication that perceptible changes would have been evident with typical program material.

All this may have remained tucked away in the inner recesses, had it not been for an article which I came across in "Popular Electronics" by Ralph Hodges: "The Direct-To-Disc Revolution".

What prompted the article was the author's involvement in the production of a test recording, including one track of 1000Hz square wave, hopefully with the fastest possible rise time. In their efforts to achieve this, the engineers involved dispensed with the tape master altogether, feeding the signal direct to the recording amplifier and concentrating all their efforts towards making the cutter do the right thing.

The problems involved, particularly when cutting to the RIAA characteristic, are well known in the recording industry: getting enough high frequency drive to the head, preventing it from overheating with such drive, controlling the tendency to ring with transients, &c. (even in the face of such problems, Ralph Hodges maintains that the disc medium is still the best and most practical currently available to the home entertainment industry.)

However, that is by the way.

In explaining their avoidance of a magnetically recorded master recording — always a great convenience — Hodges states as a truism that to put such a critical test signal through a normal tape mastering chain would be the surest way not to get a visually satisfying square wave. With very rare exceptions, he says, the magnetic medium is characterised by "oodles of phase shift".

Hodges sees this as no problem for a sound only signal: "It's easy to demonstrate that you can put a square wave through huge amounts of it and never hear the difference."

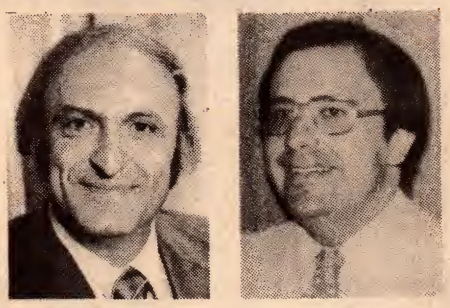
Seemingly, this is in flat contradiction to what I've just got through saying but, on the other hand, it may not be. What is apparent from a mono source in an anechoic chamber may not be so under more typical listening conditions. (N.B. my earlier reservations).

But that is not all, and I continue the quote:.... keeping track of phase phenomena in a modern recording facility handling music signals by means

Technics SB-10000 linear phase 3-way horn system

Featured prominently in the company's hifi displays and auditoria in Osaka and elsewhere, the SB-10000 is top of the Technics line. The tweeter, using a boron diaphragm and the mid-range driver are both mounted in cast aluminium wide-angle horns, with the 46cm woofer in a reflex enclosure.

AMPEX EXECUTIVES



Tape Division Manager of Ampex Canada Ltd, Mr J. R. Pariselli (left) recently visited the company's new tape manufacturing plant in Sydney, preparatory to the introduction of locally manufactured tapes on to the Australian market. Mr Frank Candelas, 28 (right) has been named as Sales Manager for the Consumer Tapes Division. He is based at the Ampex Sydney office.

HIFI NEWS — Continued

of multiple microphones, several tape machines, numerous signal processors and finally a cutting lathe is staggeringly complex. In fact, in practice, no one really attempts to do it; everyone down the line just tries to trust his ears."

This, of course, serves as the justification for those who opt for the purist approach, avoiding multiple microphones, mixing, signal processing of any kind, along with tape mastering, and feeding the signal direct to the cutting lathe. Unfortunately, they run into other problems, which reduce the marketability of their product, but that is another story.

What Ralph Hodges is saying is that phase is a near random quality of virtually every piece of programming we listen to, including much that might be rated as "superb".

Does this make nonsense of all the talk about linear phase loudspeakers?

It probably does, if our expectation of such loudspeakers is that they will open up a whole new world of sound. How can they, by simply preserving a quality that is already random?

On the other hand, the observance of a linear phase relationship may well represent a step in the right direction, even if the benefit of that step is perceptible only under special listening conditions.

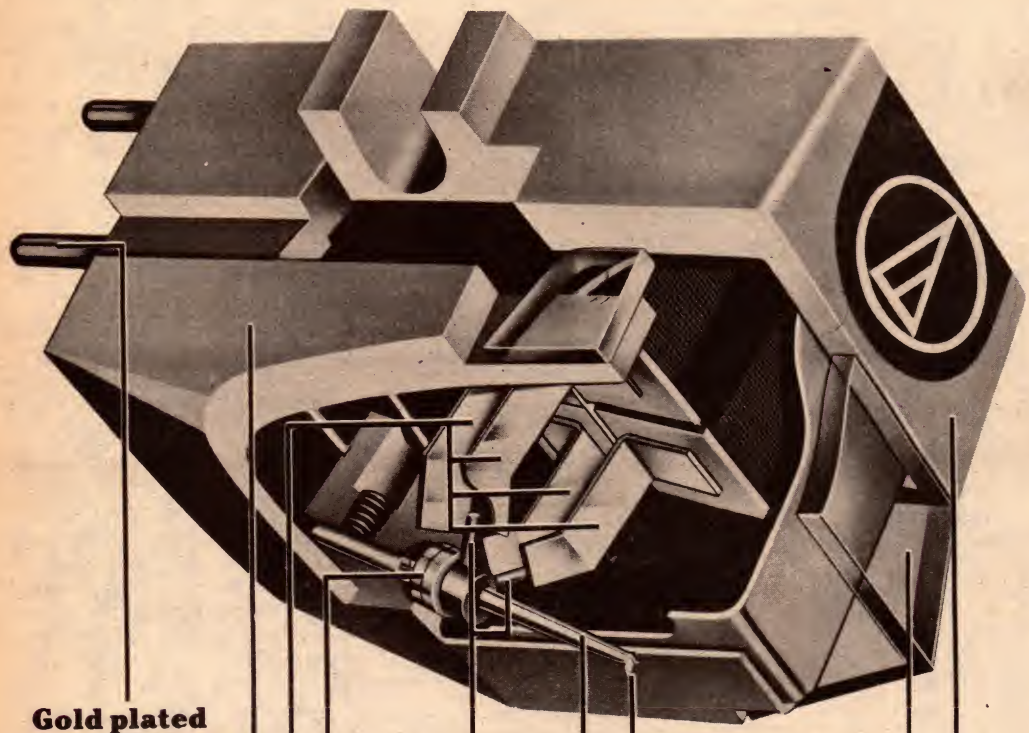
What is, or is not perceptible? That is the tantalising question which all hifi engineers have to face, because it is a subjective reaction, different for every individual.

While in Osaka, the Australian editorial panel had the chance to react to a number of competitive loudspeaker systems, operating behind a curtain and under direct control of the panel itself. Each member had a push-button and their reactions were continuously averaged by a computer.

The systems which scored best on the occasion over other price-competitive systems were the Technics SB-6000A and the Technics SB-7000A — both linear phase designs. The vote was a tribute to the nature of the sound but to what extent this stemmed from linear phase, or from design quality in other respects, was not immediately evident. Technics would hardly have focussed their effort on the cabinet work and ignored the quality of the respective drivers.

If one is to draw a conclusion from all this, it would have to be that linear phase is a "plus" feature — provided it is properly executed, and provided it is not included at the expense of something else. A manufacturer who spends more money on a stepped enclosure and then compensates by using cheaper drivers might well effect an "improvement" sideways or backwards!

Why Audio-Technica Dual Magnet Cartridges are different.



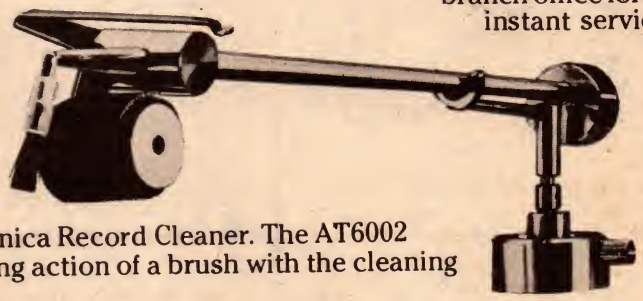
They have two tiny high energy magnets mounted almost at the fulcrum of the stylus cantilever. Each is perpendicular to "its" side of the stereo groove. Each has its own independent magnetic system, with its own set of phased coils and pole pieces. By reducing the sharing of magnetic system components, stereo separation is uniquely excellent.

The tiny magnets are easy for the stylus to move, guaranteeing good high frequency response. And radial damping of the stylus assembly insures smooth response in every plane.

The entire assembly is precisely located in the cartridge body for correct, lasting alignment. On premium models gold plated contact pins are used. Every cartridge is comprehensively tested.

Audio-Technica dual magnet cartridges are priced from $12.50 right up to the ultimate at $119.

Check your audio dealer. If he can't supply you, phone our nearest branch office for instant service.



New AT6002 Autocleanica Record Cleaner. The AT6002 combines the dirt-loosening action of a brush with the cleaning of a soft, plush pad.
Effectively neutralising static charges during playing.

Sole Australian Distributor for Audio-Technica Products.

MAURICE CHAPMAN AUSTRALIA PTY. LTD.

9 Horden Place, Camperdown. NSW 2050 Phone: 516 4599

Neil Muller, 8 Arthur Street, Unley. SA 5106 Phone: 74 1162

150 Burwood Road, Hawthorn. Vic. 3122 Phone: 818 1730

Soundline Pty. Ltd., 883 Wellington Street, Perth. WA 6000 Phone: 22 5177

123 Abbotsford Road. Mayne. Qld. 4006 Phone: 52 2480

Wills & Co. Pty. Ltd., 7 The Quadrant, Launceston. Tas. 7250 Phone: 31 5688

PKB89203

Photographed at Alberts Studio – Sydney
Recording Engineer – Bruce Brown

Now....the professional tape gains amateur status

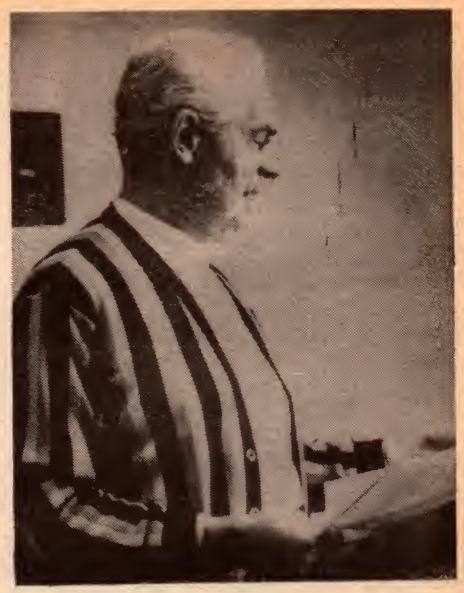
In top recording studios throughout the world, the professionals entrust original master recordings to Ampex tape. Very soon, Ampex studio quality cassettes and tapes will be available to you, from our new Australian manufacturing facility equipped to critical Ampex standards.
Soon your parameters of excellence will change. Ampex cassettes and tapes will challenge your amateur status. To be offered by selected retailers . . . . . well worth waiting for.

AMPEX AUSTRALIA PTY. LIMITED 4 Carlotta Street, **ARTARMON.** N.S.W. 2064. Phone: 439 4077

ACT/02 T

FRED WARING

and his Pennsylvanians



"Old bandleaders never die; they simply fade away." Although I use the phrase in relation to Fred Waring, it is in no sense a put-down. He still has his faithful followers and he still organises tours of his "Pennsylvanians" when he feels the urge to do so — at the age of 78.

by NEVILLE WILLIAMS

Why Fed Waring?

Simply because, over a pleasant dinner at Edinburgh's George Hotel, four of us around the table got to talking about hifi, people's likes and dislikes in the field of music, and the musicians who play it.

It turned out that the other couple at the table had been personal friends of Fred Waring for many years. Woody German had been the group's accountant and had kept an eye on the black columns and the red columns that spelled out the financial implications of the concerts and the publicity up front. His wife Mary German, a public relations officer, had not been directly employed by Fred Waring but had been sensitive to their successes and failures.

In fact, Fred Waring's entry into show business had been a mixture of those two elements: success and failure. Fred had already been enrolled in the Pennsylvania State College and, in the normal way, would have progressed towards a formal academic career. But music was in his blood and, along with his brother Tom, he got together a group of five musicians for in-college functions, under the name of Bandjazztra. Musically the group was an immediate success but it spelled failure for Fred Waring, the student. Music simply took over.

The group migrated to Hollywood and were good enough to earn movie appearances in the early thirties and to make the airwaves on network radio.

It was during this period that Fred Waring introduced choral backing as support for his instrumental music and the public loved the new sound: please, more emphasis on the vocals. They also responded warmly to the song "Sleep" and the magic formula emerged: Fred Waring and his Pennsylvanians, his theme song "Sleep", network radio, and a cigarette sponsor to pay the bills!

Although the man the public knew was Fred Waring, much of the credit for the group's success belonged to his brother Tom, according to Woody and Mary German. Tom was a fine pianist, arranger and composer, with abilities as a painter and poet for good measure. And there were men like Ray Wringwold and Harry Simeon, later conductors in their own right, and drummer/comedian Poley McLintock.

With rising success in the radio and recording field, requests poured in for copies of Fred Waring arrangements and, at first, these were supplied on a casual basis. But it soon became apparent that the Pennsylvanians were giving away a valuable asset and Fred Waring accordingly set up Shawnee Press to publish and distribute the group's arrangements. As it grew, Shawnee Press employed professional arrangers to take over much of the creative work that had hitherto fallen to the players and singers in their spare time.

Fred Waring and his Pennsylvanians reached their peak in the golden days of radio and there seemed to be no reason why they should not carry right on into the new post-war medium — television. But, somehow, it didn't work that way.

Woody and Mary German told how they watched that first television appearance, along with many other Fred Waring fans, at a time when TV owners could still expect visitors to drop in when something special had been advertised.

What they saw was an elaborate presentation for that period — lots of activity on the screen to support the Pennsylvanians. The producers and sponsors had assumed that no one could possibly want to listen to music from a group simply posed on the sound stage.

In fact the video action failed to captivate the "viewers" and succeeded only in confusing those who wanted to listen to the Fred Waring sound. It was left to Mitch Miller and Lawrence Welk, many years later, to capitalise on the simple formula which Fred Waring's producers had passed over.

But to Fred Waring, it is all now rather remote history. Born in 1900, he is 78 years of age and with neither the will nor the need to maintain a full-time group of professional musicians committed to a demanding tour program. He rounds out a much smaller group with part-time professionals and makes far fewer appearances.

But, for many, the name of Fred Waring still lives on, epitomising the kind of music they most like to listen to.

Maybe, one of these days, a new group of enthusiasts will build around a new Fred Waring: to be precise, Fred Waring Junior, a rising musician fronting his own rock band!

Ortofon phono cartridges in the M20 Super series and the entire MkII range are designed to operate into a load of 47k ohms shunted by about 400pF. Where the cable capacitance is less than this, a response peak may be evident in the 18-20kHz region. To overcome any possible problem, Ortofon have released a 210pF capacitor designed to slip over the cartridge pins, as shown. It will be fitted as standard to new cartridges but can be removed where the cable system already has the required capacitance. (Inquiries: Harmon Aust. Pty Ltd, P.O. Box 6, Brookvale 2100. Tel 02 939 2922).

COMMUNITY BROADCASTING: Delegates from six states attended a symposium recent held at the studios of the Christian Broadcasting Association, at Five Dock, Sydney. Their purpose was to set up a National Christian Broadcasting Association (NCB) with the ultimate aim of operating community broadcast stations, initially in the major capitals. The stations would be independant but would exchange ideas and program material as appropriate.

Mr Ben Whitnall 9 (pictured) was elected President and former Queensland University Professor, Mr Merv Dunkin was elected secretary. Mr Whitnall, with a background in both the engineering and management side of commercial broadcasting, has spearheaded the re-equipment of the Five Dock

studios for FM stereo broadcasting.

Re-equipment has been no mean task, considering that the studios have been in constant use recording material for transmission by commercial stations throughout Australia. In addition, the studios have been the virtual headquarters for ethnic broadcasting in Sydney with programs, including an automated night-time service, fed by landline from the studios to the 2EA transmitter at Ashfield, an inner western suburb.

Looking to the future, Mr Whitnall explained that the aim of the Association would not be to broadcast "wall-to-wall" religious programs, which could be expected to attract only a very selective listening audience. The approach would better be described as a "quality of life" format, involving informative and entertaining programs, likely to find wide community appeal. Backing up the NCB stations would be a telephone caring service staffed by trained counsellors and working in conjunction with other established community services.

TANDY ELECTRONICS have recently released their Realistic Mach-1 loudspeaker system, selling for under $500 and "able to handle easily 100 watt musical surges", according to their press statement.

The bass is handled by a 38.1cm acoustic suspension woofer with brass voice coil, while the range 800 to 8000Hz involves a multicell horn. Frequencies above 8000Hz are handled by a horn tweeter, with level controls to permit adjustment of the mid — and high-range to suit individual requirements.

Further details can be obtained from any of the 111 Tandy stores around Australia or from Tandy International Electronics Pty Ltd, 280-316 Victoria Road, Rydalmere 2116.

A NEW MASTERFICHE AUDIO-VISUAL SYSTEM

For details: Brian M. Carey, Commercial Public Relations (Aust.) Pty Ltd, 157 Walker St, North Sydney 2060. Tel: 02 929 4911.

Representing a new look in audio visual presentation, this Revox Audiocard system is being distributed in Australia by AWA Rediffusion Pty Ltd. Produced by Willi Studer of Switzerland, it stores the visuals on a single master fiche transparency, about the size of a normal postcard. Up to 60 pictures can be accommodated on one fiche, in colour or black and white, suitable for rear projection for a small group or by front projection up to 1 metre wide. The pictures can be shown in any order, with less than 1 second delay, either by manual selection, or automatically by code signals on one track of a two-track commentary tape.

PHILIPS Electronics Components and Materials Division have recently released a new loudspeaker system in kit form, which they hope will form a worthy companion unit to their well established AD12K12 kit.

The new unit, known as the AD8K12 is smaller, being housed in a sealed 25 litre enclosure. However, thanks to its 8-inch woofer, it boasts a 40W power rating, and is a 3-way design using the Philips ADF600/4000/8 crossover network, with 3-position level switches controlling the mid and high range. The network was described, by the way, in the January 1976 issue of "Electronics Australia".

A frequency plot using the Bruel & Kjaer pink noise method, and referenced to 400Hz=0db, shows a response near to or somewhat above reference from 200Hz to about 15kHz. Below 200Hz, it tapers to about —3dB at 80Hz, rolling to about —8dB at 40Hz —Better than average for a compact system. (For details: Philips Electronics Components and Materials Division, 67 Mars Rd, Lane Cove 2066. Tel. 02427 0888).

TEAC AUSTRALIA PTY LTD is a new company which has been formed as a joint venture between Japan's Tokyo Acoustic Company and Australia Musical Industries Pty Ltd, a subsidiary of Brash Holdings Ltd.

Former managing director of AMI Pty Ltd, Mr Gavin Muir, will manage the new company. TEAC products in NSW, Queensland and Western Australia will be distributed by BTS Sales & Service, a newly formed group in independant companies. South Australian distribution will be handled by PGA and Associates.

Main emphasis of the new TEAC operation will be on equipment specifically suited to the needs of the Australian market.

2MBS EQUIPMENT STOLEN: Community-owned FM radio station 2MBS-FM can hardly afford to lose expensive equipment, but recently discovered missing from their OB store were 3 condenser microphones and 2 cables. The microphones, 2 "Neuman" UA87 (Serial Numbers 20063 and 18127) and 1 "AKG" CK414ED (Serial Number 1419) were discovered missing on Monday, February 6 along with two special cables with "Neuman" connectors.

David James, Manager of 2MBS-FM (and Chatswood Police) would be grateful if anyone could supply any information (439-4777) as to the whereabouts of these valuable items which formed part of 2MBS' outside broadcasting kit.

CASSETTE STORAGE: Described as elegantly simple, a new cassette storage rack is essentially a length of anodised aluminium channel which can be attached to an appropriate vacant piece of wall. Transparent plastic dividers along the bottom lip provide stable storage for up to 42 cassettes. For further information contact Dindy Marketing (Aust.) Pty Ltd, PO Box 555 Tweed Heads 2485 or phone the company on 075 36 4629.

fact:
the IV does more... *much more!*

new!

Shure V15 Type IV

SUPER TRACK IV™

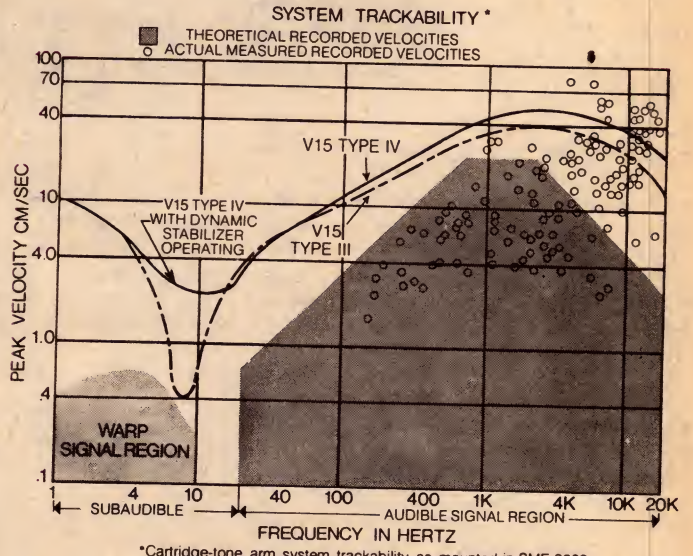
Stereo Dynetic® Phono Cartridge

The creation of the new V15 Type IV is a tour de force in innovative engineering. The challenge was to design a cartridge that would transcend all existing cartridges in musical transparency, technical excellence, and uniformity. The unprecedented research and design disciplines that were brought to bear on this challenge over a period of several years have resulted in an altogether new pickup system that exceeds previous performance levels by a significant degree—not merely in one parameter. but in totality.

In fact, this pickup system has prevailed simultaneously over several extremely difficult music re-creation problems which, until now, have defied practical solutions. Most of all, this is an eminently musical cartridge which is a delight to the critical ear, regardless of program material or the rigorous demands of today's most technically advanced recordings.

THE V15 TYPE IV OFFERS:

- Demonstrably improved trackability across the entire audible spectrum—especially in the critical mid- and high-frequency areas.



*Cartridge-tone arm system trackability as mounted in SME 3009 tone arm at 1 gram tracking force.

- Dynamically stabilized tracking overcomes record-warp caused problems, such as fluctuating tracking force, varying tracking angle and wow.
- Electrostatic neutralization of the record surface minimizes three separate problems: static discharge; electrostatic attraction of the cartridge to the record; and attraction of dust to the record.
- An effective dust and lint removal system.
- A Hyperelliptical stylus tip configuration dramatically reduces both harmonic and intermodulation distortion.
- Ultra-flat response—individually tested to within ± 1 dB.
- Lowered effective mass of moving system results in reduced dynamic mechanical impedance for superb performance at ultra-light tracking forces.

For more information on this remarkable new cartridge, write for the V15 Type IV Product Brochure (ask for AL569), and read for yourself how far Shure research and development has advanced the state of the art.

SHURE®

AUDIO ENGINEERS P/L
342 Kent Street,
SYDNEY 2000 N.S.W.

AUDIO ENGINEERS (Vic.)
2A Hill Street,
THORNBURY 3071 Vic.

AUDIO ENGINEERS (Qld.)
51A Castlemaine Street,
MILTON 4064 Qld.

ATHOL M. HILL P/L
33 Wittenoom Street,
EAST PERTH 6000 W.A.

AE129/FP

Technics RS-7500US Stereo Elcaset Deck

Developed by a consortium of Japanese audio manufacturers, the Elcaset system is intended to overcome the major limitations of the conventional compact tape cassette. One of the members of the consortium is Matsushita Electrical Industrial Co Ltd, manufacturer of the Technics RS-7500US Elcaset deck reviewed here.

"Elcaset" is derived from "large cassette", which correctly describes this new type medium developed by a consortium of well-known Japanese audio manufacturers — JVC, Matsushita (Technics), Sony and Teac. As shown in the photograph on the following page, the Elcaset is a whopper compared to the conventional cassette.

The Elcaset is designed to overcome the disadvantages of the conventional cassette, some of which are low tape speed, narrow track width and the need for the tape heads to move and contact the tape rather than vice versa. This last characteristic means that there is great difficulty in ensuring correct tape azimuth and alignment — these two parameters can vary each time a cassette is inserted into a typical deck mechanism.

And until the application of considerable ingenuity by some Japanese manufacturers, it was not possible to have separate recording and playback heads. In spite of all these disadvantages, the once-lowly cassette has been highly refined.

By using twice the tape speed, 9.5cm/sec and almost double the tape width, 6.3mm, the Elcaset gains the advantage of greatly improved freedom from high frequency saturation. The tape heads can also be somewhat larger and have bigger gaps, which makes for easier manufacturing while still maintaining high performance.

Since the tape is pulled out of the Elcaset when it is inserted into a deck, the tape heads are rigidly fixed and it is easier to provide a separate playback head, without the jiggery-pokery necessary in a conventional cassette deck.

As our "see-through" diagram of the Elcaset shows, it is also considerably more complex than the conventional cassette. The two tape hubs are locked by a ratchet mechanism when the Elcaset is removed from the transport mechanism. The Elcaset housing has identification holes to indicate (to the tape deck) whether it is a Dolby recording, and the type of tape formulation (so the deck can adjust bias and frequency compensation levels). The housing also has end-of-tape detection windows and retractable erase prevention tabs. Finally, for the sake of the purblind user, there is an identification hole to indicate side one.

If you have found it hard to accept the large size disparity between Elcaset and standard cassette, you will find it even harder to comprehend the size of the Technics RS-7500US. It is really big: 483mm wide, 252mm high, including rubber feet and 350mm deep, including knobs and other projections. Nor is it a lightweight, at 14kg.

Like a good deal of other high fidelity equipment, the RS-750US Elcaset deck

Accutrac. The turntable with eyes.

Introducing Accutrac. The only turntable in the world that lets you tell an LP which selections you want to hear, the order you want to hear them in, even how many times you want to hear each one.

Sounds like something out of the 21st century, doesn't it? Well, as a result of Accutrac's electro-optics, computer programming and direct drive capabilities, you can have it today.

Just imagine you want to hear cuts 5, 3 and 7 in that order. Maybe you even want to hear cut 3 twice, because it's an old favorite. Simply press buttons 5, 3, 3 again, then 7. Accutrac's unique infra-red beam, located in the tonearm head, scans the record surface. Over the recorded portion the beam scatters but over the smooth surface between selections the infra-red light is reflected back to the tonearm, directing it to follow your instructions.

What's more, it can do this by cordless remote control, even from across the room.

The arm your fingers never have to touch.

Since Accutrac's tonearm is electronically directed to the record, you never risk dropping the tonearm accidently and scratching a record, or damaging a stylus.

And, since it cues electronically, too, you can interrupt your listening and then pick it up again in the same groove, within a fraction of a revolution. Even the best damped cue lever can't provide such accuracy. Or safety.

What you hear is as incredible as what you see.

Because the Accutrac servo-motor which drives the tonearm is decoupled the instant the stylus goes into play, both horizontal and vertical friction are virtually eliminated. That means you get the most accurate tracking possible and the most faithful reproduction.

You also get wow and flutter at a completely inaudible 0.03% WRMS. Rumble at −70 dB (DIN B). A tracking force of a mere 3/4 gram. And tonearm resonance at the ideal 8-10 Hz.

The Accutrac 4000 system. When you see and hear what it can do, you'll never be satisfied owning anything else.

Its father was a turntable. Its mother was a computer.

The Accutrac 4000

ADC

BSR (A'asia) Pty. Ltd. Anne St., St. Mary's. Box 272 St. Mary's NSW 2760. Phone 6230375/6. Telex 23159. Telegrams "BSR" St. Mary's 2760

Audio Dynamics Corporation
A BSR Company

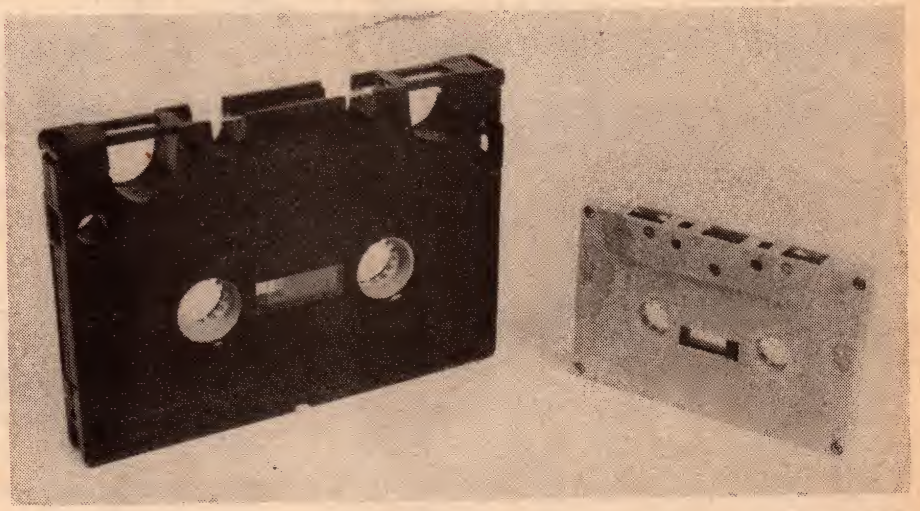
COMPTON BSR 142

is designed to fit into a standard 19-inch rack. This does not seem like a good trend, from several points of view. A rack full of equipment looks quite out of place in most lounge rooms. Also, as yet we have not seen a rack-mounted turntable.

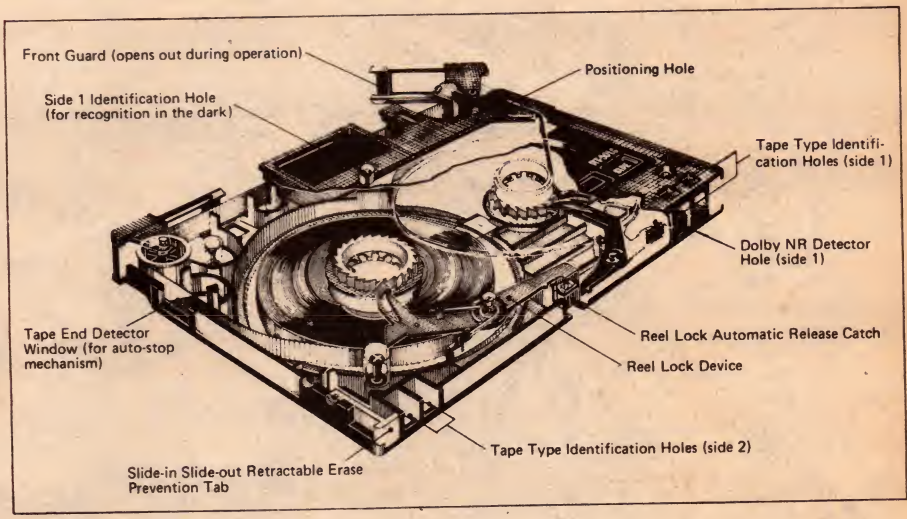
Controls on the 7500 are little different from those on a conventional cassette deck. One noticeable omission is the group of switches to select bias, compensation and Dolby Noise reduction (where available). The Elcaset deck has automatic sensing of these conditions. So instead of switches, the 7500 has a group of three coloured lights to indicate the type of tape being used.

Currently, three different tape formulations are available in Elcaset format: low-noise ferric oxide, ferrchrome and chromium dioxide. Our tests were made with low noise ferric-oxide tapes, as supplied by Technics.

A jarring note intrudes when the user actually pushes one of the levers to operate the transport mechanism. For example, pushing the eject lever to open the Elcaset compartment makes an obtrusive metallic whirring sound. Again, when the door is pushed closed, with Elcaset inside, the same objectionable noise is repeated. Then, depending on the prior mode of the transport, a short burst of this audible machination is emitted every time one of the levers is pushed.



The Elcaset format is much larger and more complicated than the conventional cassette as these pictures show.



The noise referred to is actually produced by part of the mechanism which lifts the tape out of the Elcaset, brings it into contact with the heads and pushes the pinch-roller against the capstan. The mechanism has a damper system which consists of several plastic reduction gears and a miniature fan. It is the damper gear system which actually produces the noise.

We were not at all impressed by this feature. Apart from their noisy accom-

REAL POWER LINEUP

U-60D

44μA movement — quality performance, diode protected.
Temperature measurement of −30°C to +150°C with extra probe.

460-ED

10μA movement — 100kΩ/V' varistor protected.
Polarity reversal switch — negative measurements.
Equalizing transformer — common shunts & jacks for 1.2A & 12A DC/AC.

N-501

2μA suspension movement — 0.05mA/1mV resolution.
Double protection — fuse & Si diode.
Constant 1MΩ input impedance (ACV) — RF-diode rectified current direct to movement.

CAM-250D

Clamp meter
Economical and multi-function.
Single motion core arm.
Compact yet provides 4 ranges on ACA and 2 ranges on ACV

WARBURTON FRANKI sanwa

ADELAIDE 356-7333 BRISBANE 52-7255 HOBART 23-1841 MELBOURNE 699-4999
PERTH 65-7000 SYDNEY 648-1711 WELLINGTON, N.Z. 69-8272

New 'LORLIN' supa-switches from C&K

TYPE MS
Rotary action DPDT mains switch suitable for inductive circuits 4A at 250V, 80A surge.

TYPE CK
Inexpensive, totally enclosed, single bank, 12 position rotary wafer switch in 1,2,3 & 4 pole.

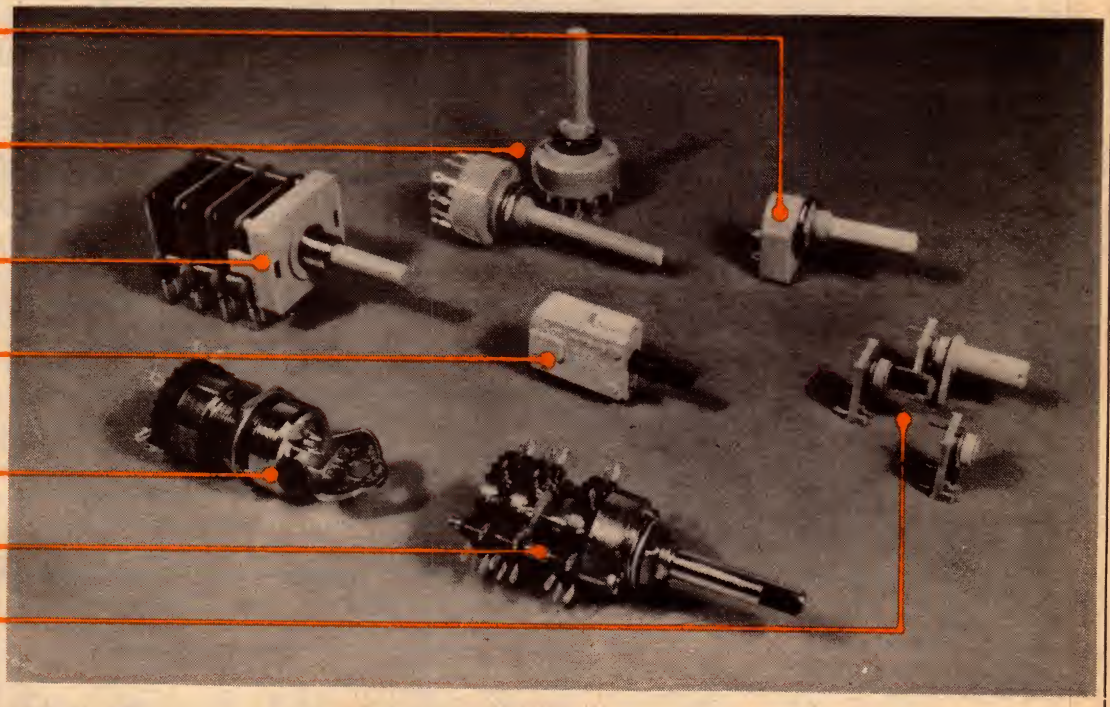
TYPE PT
Printed track switch of outstanding cost saving design.

TYPE PBMS
Pushbutton mains switch push on/push off. Ideal for T.V. industry, 4A at 250V, 80A surge.

TYPE KRA
Key operated rotary for maximum security.

TYPE RA
1" diameter miniature rotary, 22 clip, 12 position.

TYPE MR
Single pole rotary, PCB mounting, 2 or 3 position.



C&K COMPONENTS

C&K Electronics (Aust.) Pty Limited

Office 2/6 McFarlane Street Merrylands NSW 2160
PO Box 101 Merrylands 2160 Telephone 682 3144 Telex AA23404

Agents: Melbourne 88 5282/Adelaide 269 2544/Brisbane 36 1277/Perth 458 7111

paniment, the transport levers are quite heavy to operate. In fact, a machine in this price range really should have all-solenoid control. At least one competitive Elcaset deck has this feature, although it lacks the automatic tape-type sensing.

The rear panel is almost bare apart from two pairs of RCA sockets, a DIN socket and the AC voltage selector. The 7500 is fitted with a two-core mains flex and moulded two-pin plug similar to that fitted to electric shavers. The rear panel is marked with the "double insulated" symbol (a square within a square) but neither the owners manual or any supporting information makes any mention of this feature or whether it conforms to Australian standards.

A single DC motor with tachometric feedback drives the mechanism via a number of belts. A large flywheel is used to damp out drive variations to the capstan, ensuring low wow and flutter figures.

Performance testing reveals the real potential of the Elcaset medium. We found we could obtain credible results even at OdB reference level. At this level, which shows evidence of severe high frequency saturation on conventional cassette decks, the Elcaset really shines. We obtained a frequency response with—4dB points at 20Hz and 16kHz. At a level of minus 10dB, the response improves to give a —3dB point at 18kHz.

Finally, at the usual testing level of —20dB, we recorded a frequency response from 20Hz to 20kHz within +½ and —2dB, which is excellent. Separation between channels is also very good, with a best figure of 46dB at 1kHz ranging up to 28dB at 20kHz. For most of the range the separation is better than 40dB.

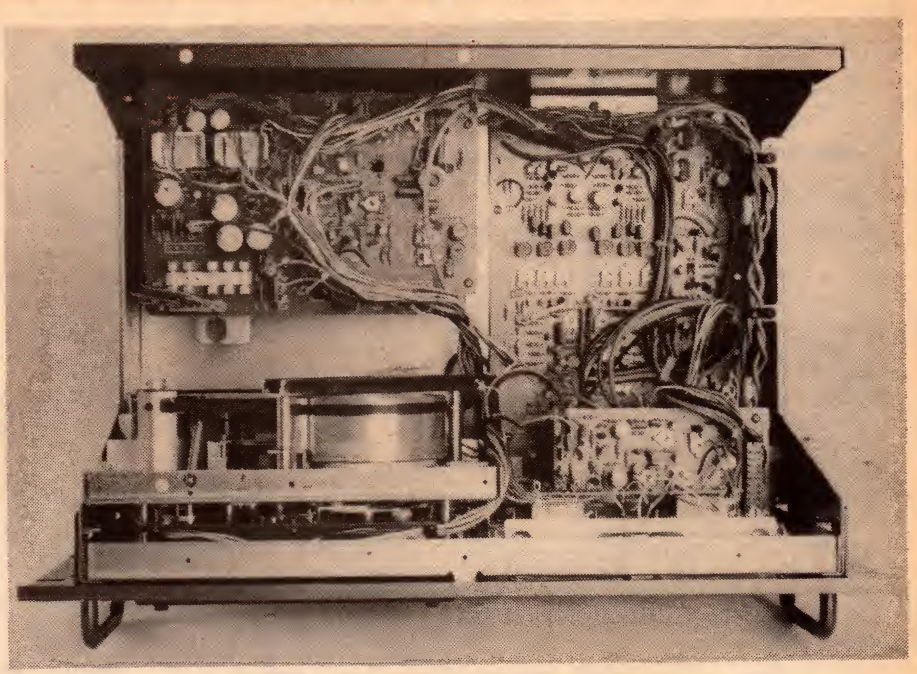
Another indication of the superiority of the Elcaset format is shown in the distortion figures obtained at 1kHz: OdB, 0.7%; +3dB. 0.9%; +6dB, 1.5%; +8dB, 3% and +9dB, 4.5%. This means that the recording level meters can be driven well over FSD and still produce clean recordings.

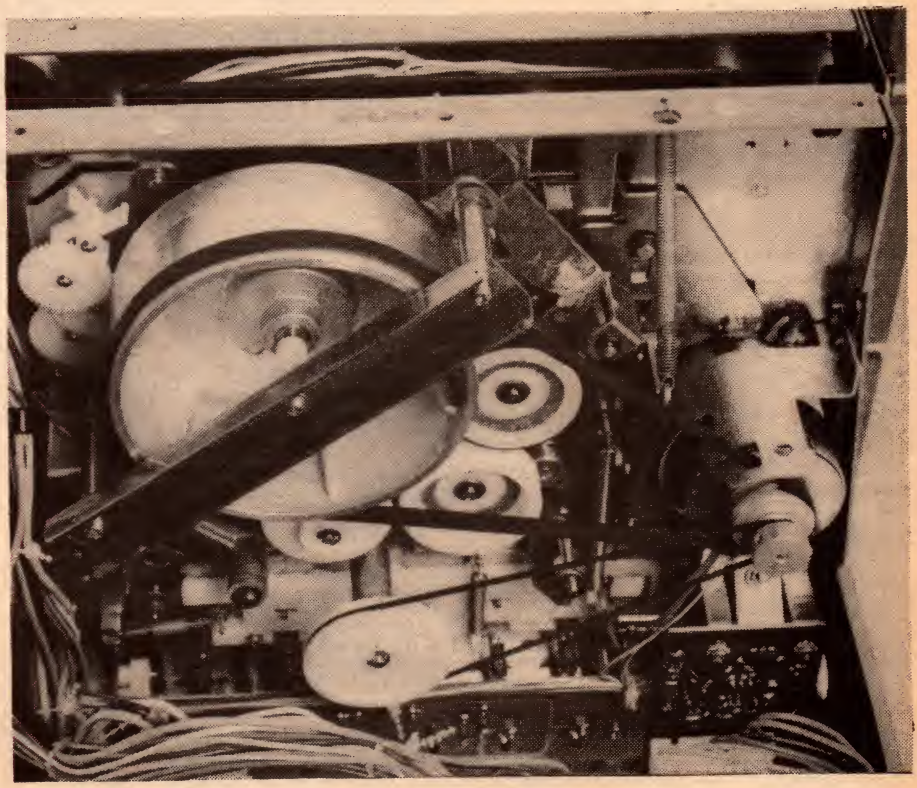
Wow and flutter was around 0.06% to 0.07% DIN, which is excellent.

Not so good is the signal-to-noise ratio. We obtained an unweighted figure of 47dB with respect to OdB reference level. While this gives an overall dynamic range of say 55dB, it is still not subjectively as good as a high performance cassette recorder with Dolby noise reduction. While the 7500 Elcaset deck gives very clean wideband recordings at high levels, the low level audible tape hiss does detract from an otherwise superb result. It needs Dolby noise reduction.

For a number of reasons then, our reaction to the Technics RS7500US is equivocal. The Elcaset demonstrates a performance potential well in excess of that ever likely to be obtained with conventional cassettes, but we do not think that this first generation Elcaset deck has fully realised this potential.

Recommended retail price of the Technics RS-7500US Elcaset deck is $899.00 including sales tax. Further information on Technics products can be obtained from high fidelity retailers or from the Australian distributors, Haco Distributing Agencies Pty Ltd, 5769 Anzac Parade, Kensington, NSW 2033 (L.D.S.)





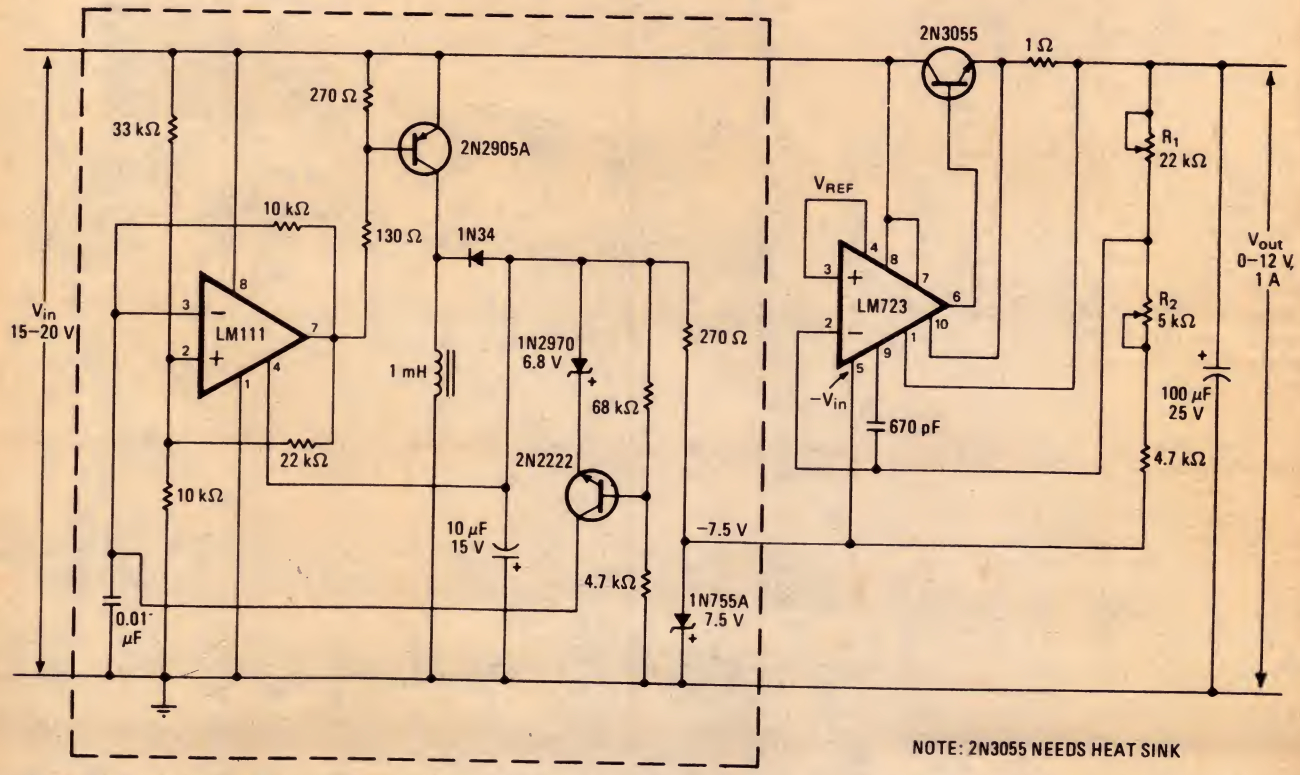
Two views inside the Technics RS-7500US. The damper system referred to in the text is at top, left hand corner of the photo below.

Circuit & Design Ideas

Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

DC-DC power supply regulates down to OV



NOTE: 2N3055 NEEDS HEAT SINK

In most DC-input, regulated power supplies, regulation is poor when the desired output voltage is less than the source's internal reference voltage. In addition, circuit considerations usually limit the minimum reference voltage attainable and consequently the minimum regulated output voltage possible. This circuit, with a configuration that can bring the reference voltage to virtually zero, overcomes both problems.

The LM723 voltage regulator shown, which provides 12V at 1A, must be biased with a negative supply voltage at its -Vin port (pin 5) for proper operation. This voltage is provided by the switching inverter shown within the dotted lines.

The LM111 voltage comparator is configured as an astable multivibrator that oscillates at a frequency of about 10kHz. With the aid of the 1mH inductor, which generates the counter EMF required to produce a negative potential from a switched-source voltage, the inverter delivers a well regulated -7.5V to the -Vin port of the 723.

The magnitude of this voltage is essentially equal to that of the regulator's internal reference voltage, Vref, appearing at pin 4, and properly biases its voltage-reference amplifier. This condition in turn precipitates a condition in the amplifier whereby Vref clamps to ground potential. Thus the output voltage may be adjusted throughout its maximum possible range by potentiometers R1 and R2. Although the potential of Vref as measured with respect to ground has been changed, the circuit will retain the regulating properties of the 723. Both the line and load regulation of the supply are 0.4 per cent.

(By P. R. K. Chetty and A. Barnaba, in "Electronics".)

Making electronic clocks immune to flicker

An occasional "flicker" on the AC line can interrupt power to a clock for up to a second. This can cause the filter capacitor in the clock's power supply to discharge through the digital displays to the point where the clock stops and so must be reset for accurate time.

A typical power supply for a digital clock consists of a transformer, two diodes and a filter capacitor. The flicker eliminator modification in the circuit consists of the components inside the dashed-line box. Now, power for the clock chip is obtained via D3, R1 and C3. When the AC line flickers, the current drawn by the displays will begin to discharge C1 but the charge on C2 will not go to the displays because under this condition D3 will be in reverse bias. Hence, while the charge on C1 might be quickly drawn off by the displays, the power delivered to the clock chip from the charge on capacitor C2 will remain relatively constant.

Under normal conditions, C2 can keep the clock chip (but not the displays) operating for several minutes.

Philips
Motional Feedback Speakers.
A step closer to sound perfection.

At Philips, striving for perfection is one of our hallmarks. Now, after years of exacting research in our European laboratories, we've come very close to the ultimate in Hi-Fi reproduction. We've developed a very compact way of reproducing low frequencies that's simply known as MOTIONAL FEEDBACK.

A piezo-electric crystal built into the cone of the woofer converts the acceleration of the cone into an electrical signal. The acceleration of the cone is linearly translated back to the original signal driving the loudspeaker. This signal is fed back to the input of the amplifier incorporated in the enclosure and compared with the original signal, thus enabling the loudspeaker to be immediately corrected at the slightest deviation. In this way, the acoustical behaviour of the woofer can be completely controlled. This has the following advantages:

1. The resonant frequency is registered as a deviation from the original signal and corrected.
2. Unwanted vibrations (distortion) are reduced.
3. The correction signal forces the loudspeaker to produce the extremely low notes clearly.
4. It becomes possible to use smaller loudspeakers and smaller enclosures for reproducing undistorted low notes at a very high sound pressure level.

Specifications — Model 544
Volume: 15 litres; 9 litres acoustic
Total power of amplifiers: 60 Watt, cont. sine wave power
Frequency response: 30-20,000 Hz
Treble filter: continuously variable, 0-18 dB per octave, –3 dB at 7,000 Hz
Cross-over frequencies: electronic cross-over at 500 Hz, passive cross-over at 3,000 Hz
Input sensitivity: continuously variable 1-23V at 100 kohm
Amplifier for woofer: 40 W cont. sine wave power
Amplifier for squawker and tweeter: 20 W cont. sine wave power

Specifications — Model 541
Volume: 8 litres; 4.5 litres acoustic
Power of amplifier: 30 Watt cont. sine wave power
Frequency response: 35-20,000 Hz
Cross-over frequency: 1400 Hz
Input sensitivity: 1 V at 10 kohm, for connection of pre-amplifiers
7.5 V at 100 Ohm, for connection of low power amplifiers
19 V at 100 Ohm, for connection of high power amplifiers

All specifications are subject to alteration without notice.

PHILIPS

We want you to have the best

367 2077

JVC speaker technology has one aim...

Let's face it, the main task of any speaker is to reproduce sound, faithfully, clearly and with low distortion, if any. The way they deliver what we at JVC call 'The Musical Truth'.

The musical truth is something special in sound. It's an indication that your records sound as good in your listening room as they did at the recording studio. These three computer designed JVC SK series speakers do just that, pure hi fi reproduction.

Our engineers have perfected a computer-assisted way of measuring speaker performance that actually translates acoustic response into visible patterns. This is the unique JVC Phase Moire Propagation Pattern technique. With the use of advanced electronic computers we actually see how speaker units and enclosure interact acoustically. This technique was used in the development of these three JVC SK series speakers.

But do yourself a favour. Listen to the reproduction at your JVC dealer.

PHASE MOIRE PROPAGATION METHOD

Smooth undulating JVC Series Speaker System Pattern.

Poorly designed Speaker System Pattern.

You'll come to one conclusion. That JVC SK-1000, SK-700 and SK-500 speakers are designed from start to finish by engineers, whose aim is to give you pure hi fi reproduction, or what we at JVC call 'The Musical Truth'.

SPECIFICATIONS

	Type	Speakers	Power Handling Capacity
SK-1000	3-Way, 3-Speaker	**Woofer:** 30cm (12") Free-Edge Type. **Midrange:** 12cm (5") Free-Edge Cone Type. **Tweeter:** 2.5cm (1") Dome Type.	85 watts (RMS)
SK-700	3-Way, 3-Speaker	**Woofer:** 25cm (10") Free-Edge Type. **Midrange:** 12cm (5") Free-Edge Type. **Tweeter:** 2.5cm (1") Dome Type.	60 watts (RMS)
SK-500	2-Way, 2-Speaker	**Woofer:** 25cm (10") Free-Edge Type. **Tweeter:** 5cm (2") Free-Edge Type.	35 watts (RMS)

the musical truth!

For pure Hi Fi entertainment!

JVC

the right choice

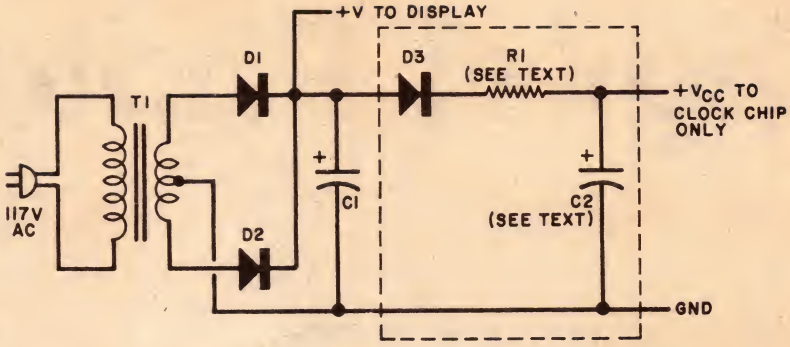
For details on all JVC Hi Fi Equipment, write to: JVC Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033

WT14/78

Also this means that you can unplug your clock and move it to another location without having to reset it.

This flicker eliminator technique can also be used with low power RAMs in computer memory systems to prevent loss of stored data when a transient flicker occurs. The amount of "safety" time depends on the value of C2 and the current demands of the memory system. Therefore, the higher the value of C2 and the lower the current demand, the longer the safety time.

(By Andrew Fraser, in "Popular Electronics".)

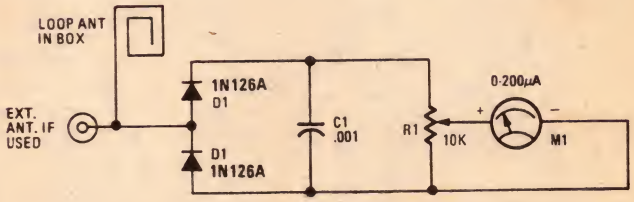


Simple field strength indicator

The circuit shows the simplicity of the field strength meter. Its aerial consists of about 20cm of insulated stranded wire glued or taped around the inside of a small plastic box. The aerial RF current is rectified by two diodes, and a 10k potentiometer provides variable attenuation for the meter. This potentiometer may be omitted and a 100k fixed resistor substituted, if the unit is always used more than 15cm away from a CB transmitting aerial. The meter is a small Japanese item with a 200uA movement. If the 200uA range is difficult to obtain, use any 50, 100, or 250uA meter.

All components except the potentiometer can be mounted on the meter and its screws. A flexible lead from the aerial connection (diode junction) was also taken to a stud nut on the rim of the box to provide for a short external aerial when used at a distance of a few metres from a CB aerial. Solder a suitable screw to one end of 15cm length of 14 or 16 gauge tinned copper wire to form the external field stength aerial. When required, it is screwed into the matching stud nut on the box.

(By W. E. Osborne, in "Radio-Electronics".)



Another heat sink

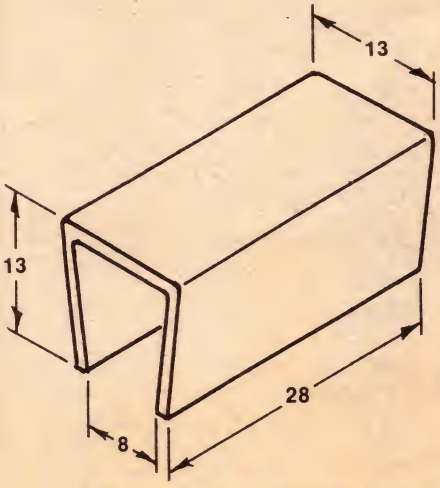
Having obtained the parts for the EA Mini Scamp Microcomputer, the problem immediately arose as to how I could solder the ICs into circuit without damaging them. One solution was to use sockets for the ICs but this would mean extra expense and a delay while the sockets were obtained, so I looked for an alternative.

Somehow I had to sink the heat from the pins and in the case of the CMOS devices, bring all the pins to the same potential. I then got the idea of a small metal clip that would fit over the pins, thus shorting them out and providing a heat sink at the same time.

The only metal which I had available at the time was some 16 gauge aluminium sheet. I made up a clip as shown in the drawing. The edges which are to come in contact with the IC pins must be smooth and straight and these may be filed as necessary. It is also a good idea to round off the corners.

The clip was used for the assembly job and it has proved to be quite successful.

(By Mr Mark Barber, 8 Hilldale Close, Ringwood, Victoria 3134.)



DIMENSIONS IN MILLIMETRES

Versatile design counts from 0.1 to 99 seconds

Digital Photo Timer

The new photographic timer described in this article utilises all digital circuitry, and has a red LED display (safe for darkrooms) to show the remaining time. Exposure times can be set between 0.1 seconds and 99 seconds.

by DAVID EDWARDS

The unit described in this article will energise a 240V mains socket for an adjustable predetermined time. It is intended to be used with a photographic enlarger unit, to automatically control the exposure time.

As you can see in the photographs, the unit is mounted in a plastic case, fitted with an aluminium lid or front panel. A 240V chassis mounting socket is mounted on one end of the case, next to where the mains cord enters.

The front panel is dominated by two rotary switches and a display window. The remaining controls are all small toggle or push switches. The rotary switches are used to preset a two-digit down counter to a number between 00 and 99. The counter contents are displayed on the LED readouts.

When the start switch, situated in the top left hand corner, is operated, the counter commences to count down at a rate determined by the range switch. The counter can be made to decrement at 1 second intervals or at 1/10th second intervals.

As soon as the counter starts to decrement, an internal latch is set, and the latch's output used to control a relay, whose contacts apply power to the output socket.

When the counter reaches 00, the latch is reset, the power is removed from the output socket, and the counter is reset to the number set on the rotary switches. If the start button is operated again, a further timed interval will occur.

A focus switch is provided, so that the timer may be bypassed, and the output socket energised continuously. This will enable the enlarger to be correctly set up and focused. The remaining front panel control is a mains switch.

The timed intervals are derived from the frequency of the mains supply, so no calibration or setting up is required. The inherent accuracy of the intervals is dependent only on the stability of the mains frequency, and is much higher than is required for normal photographic work.

The circuitry required to implement the timer is relatively complex, and requires a total of 13 integrated circuits. However these are all readily available CMOS types.

Turning to the circuit diagram, we can discuss the operation of the circuit in detail.

The counter at the heart of the unit is formed by two 4029 devices, connected as decade down-counters. Their BCD outputs are decoded by two 4511 devices, and used to drive the common cathode displays. The display intensity is set by the 220 ohm resistors.

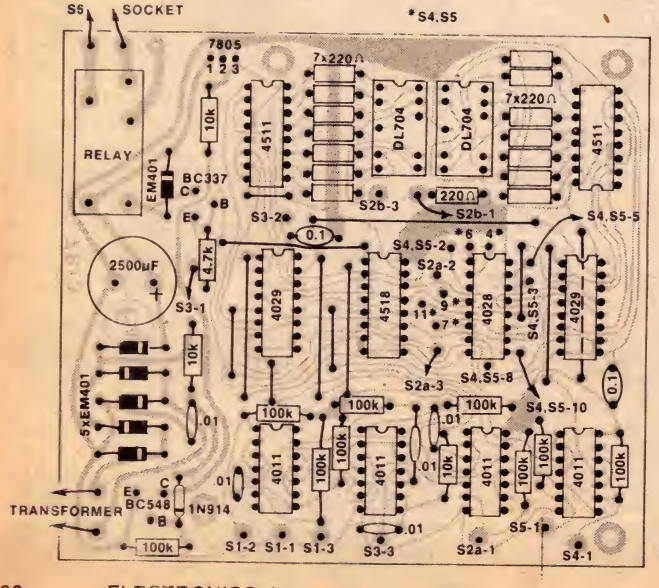
The 4029 devices have parallel loading facilities, and these are used to set the counters to the desired number. The way in which this is done is rather ingenious, however, being a form of multiplexing circuit.

A 100Hz pulsetrain is derived from the output of the bridge rectifier by a BC548 transistor, and used to clock two decade counter-dividers, implemented using a 4518 device. The dividers provide 10Hz and 1Hz signals, which are used to clock the main down counter.

The BCD output of the second counter-divider (IC 5b) is connected to the jam inputs of the 4029s, and also to the input of a 4028 BCD to decimal decoder. Each of the time setting switches (S4 and S5), selects one of the ten decoded outputs.

As the circuit is drawn, the wiper of S5 will go high for 1/10th of a second in every second, and during this time, the BCD code for "4" will be presented to jam inputs of IC 6. Let us accept for the moment that pin 12 of IC 3d is held at the logic 1 state (high).

Pin 13 of IC 3d will go high once every second for 1/50th of a second, during the time that a stable output



The component overlay pattern shows the PC board as viewed from the component side. Note the orientation of the 4511 IC in the top right hand corner of the board.

from the 4028 is present. This signal is coupled through gates 3d and 3c, and is combined with the signal selected by S5 in gates 4b and 4a.

Thus the parallel enable input (pin 1) of IC 6 is driven high for a short period while a stable BCD code of "4" is present at the jam inputs, so that the counter is loaded with "4".

In a similar fashion, as the circuit is drawn, IC 7 will be loaded with "6". If the switch positions are altered, the new input will be loaded into the counter within one second. This multiplexing scheme allows low cost 1-pole 10-position switches to be used.

We can now turn to the remainder of the circuit, and see how the timed interval is commenced and finished. Gates 1a and 1b are connected as an R-S flipflop, as are gates 1d and 1c, and gates 2a and 2b.

Flipflop 1 is used to debounce the start switch, S1. The output of this flipflop is differentiated, and used to set the second flipflop. This is necessary so that once the timed interval has commenced, the start switch has no further effects.

The normally low output of flipflop 2, which goes high when the start switch is operated, turns on gate 3b, and allows clock pulses, selected by S2a, to reach the 4029 counters. The first positive clock edge appearing at the output of gate 3b clocks the counters, and also sets flipflop 3, via gate 3a.

This last flip flop controls the output relay, via gate 2d and the BC337 transistor. Flipflops 2 and 3 remain set while the counter counts down. In order to prevent the parallel load circuits from operating, the output of flipflop 2 is used to turn off gate 3d, thus preventing loading pulses from reaching the parallel enable inputs of the 4029s.

The counter counts down till 00 is reached. At this time, the carry out pin of IC 6 goes low, signifying the end of the count. Since one more count is required to obtain the exposure time set on the switches, the trailing edge of this pulse is used to clear flipflops 2 and 3. The integrator before gate 2c is required to remove a small glitch which could otherwise cause false retriggering.

Thus flipflop 3 remains set for the duration of the number of clock pulses specified by the rotary switches, and hence the enlarger lamp remains set for the same period. There is a small delay after the start switch is operated before the lamp is energised, while the circuit waits for the first clock edge to arrive.

The second pole of the range switch is used to energise the decimal point in the most significant display when a 10Hz clock rate is selected, so that the display reads in seconds and tenths of seconds. The focus switch (S3), supplies base current to the relay transistor instead of gate 2d, and thus keeps the relay energised irrespective of the state of flipflop 3.

Construction of this project should only be attempted by experienced constructors, as some fine solderwork is required. All of the components are contained on a single printed circuit board, coded 78t3, and measuring 101 x 113mm. Twelve links are required, one of which runs under IC 7.

Fit all the passive components first, making sure to orientate the electrolytic capacitor correctly. The two wire-wrap sockets are used as spacers to mount the displays off the board. Cut about 4mm off those leads which do not pass through the board, and use them to help position the socket off the board.

Use PCB pins to make all external connections to the board, as they are easier to use, and facilitate later repairs (hopefully not required!). Do not insert the CMOS ICs until all static proof devices, such as the diodes, displays and regulator have been fitted.

Earth the barrel of your soldering iron to the board, and then insert the first CMOS IC. Solder the power supply pins first, and then the remaining pins. Pin 7 or 8 is the earth pin, and pin 14 or 16 is the positive supply line.

PARTS LIST

SEMICONDUCTORS
- *4 4011 quad NAND gates*
- *1 4028 BCD to decimal decoder*
- *2 4029 up/down binary/decade presettable counters*
- *2 4511 BCD to seven segment decoders/drivers*
- *1 4518 dual decade counter*
- *2 DL704 common cathode LED displays*
- *1 7805, LM340T-5.0 three terminal regulator*
- *1 BC548 NPN transistor or similar*
- *1 BC337 NPN switching transistor or similar*
- *6 EM401 silicon diodes*
- *1 1N914 silicon diode*

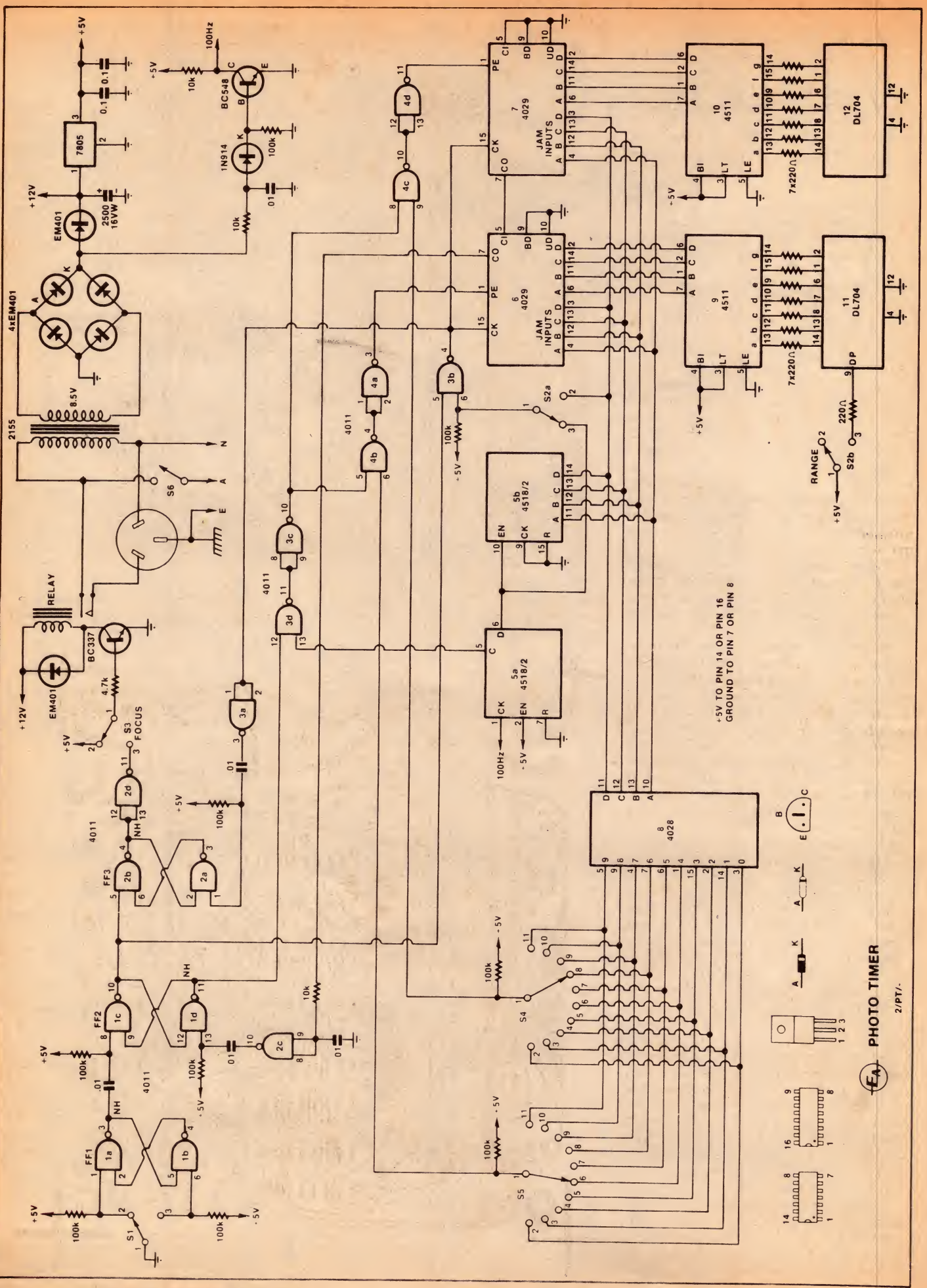
RESISTORS (all ¼W)
- *9 100k, 3 10k, 1 4.7k, 15 220 ohm*

CAPACITORS
- *1 2500uF 16VW PCB mounting electrolytic*
- *2 0.1uF polyester*
- *5 0.01uF polyester*

SWITCHES
- *2 10 position single pole rotary*
- *2 SPDT miniature toggle*
- *1 DPDT miniature toggle*
- *1 SPDT momentary contact miniature pushbutton*

MISCELLANEOUS
- *1 12V 280 ohm SPDT relay with 240VAC rated contacts*
- *1 transformer, 240V to 8.5V at 1A, DSE 2155, A&R 2155 or similar*
- *1 chassis mounting 3 pin 240V socket*
- *1 mains plug, cord, grommet and cord clamp*
- *1 3 way terminal block*
- *2 knobs*
- *1 plastic case, 196 x 113 x 60mm*
- *1 printed circuit board, coded 78t3, 101 x 113mm*
- *2 14 pin DIL wire wrap sockets*
- *1 piece of red Polaroid film, 80mm x 20mm*
- *Machine screws and nuts, tapped spacers, solder, hookup wire, rainbow cable, insulation tape, scrap aluminium, PCB pins*

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used provided they are physically compatible.


+5V
100Hz
BC548
1N914
7805
EM401
2500 16VW
4xEM401
8.5V
2155
RELAY
BC337
4.7k
S3 FOCUS
S6
4011
FF1
FF2
FF3
JAM INPUTS
4029
4518/2
4028
4511
DL704
7x220Ω
220Ω
S1
S2a
S2b
RANGE
S4
S5
+5V TO PIN 14 OR PIN 16
GROUND TO PIN 7 OR PIN 8
PHOTO TIMER
2/PT/-

Once the PCB is completed, put it to one side, and commence to fit the hardware into the case. The general arrangement we used can be seen in the photographs, and is recommended. The mains cord enters through a grommetted hole, and is clamped to the bottom of the case. The earth lead is securely connected to the transformer frame, and to the metal front panel.

A three-way terminal block is used to terminate the active and neutral connector wires, and the wires from the mains switch. This latter component should be well wrapped with insulation tape, to minimise shock hazards.

The PCB is mounted on standoffs, so that it is as close to the front panel as possible. The height of the electolytic capacitor will be the limiting factor. The connections to the various switches are best made with rainbow cable. We separated the individual wires, and then bound the finished wiring into two cables, as this gave a neater result.

One cable contained the twelve wires from the two rotary switches, while the other cable contained the wires to the other switches. Keep the finished cables well away from the mains leads and components.

The regulator is bolted to the side of the case, with a small piece of scrap aluminium used as a heatsink. Make sure that this is kept well away from the mains connections to the PCB.

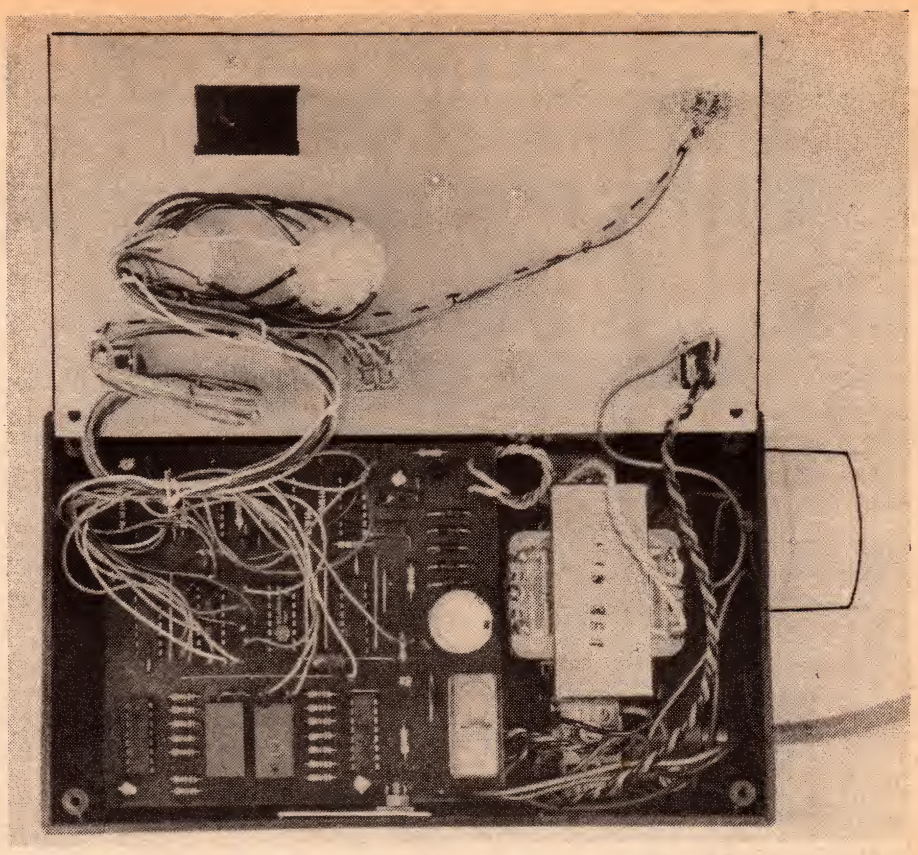
We recommend that the connections to the relay be left off the board, while it is tested. You will be able to see and hear the relay operate, and this will indicate correct operation. On first switch on, the relay may energise momentarily. If this is not desired, break the track leading to pin 12 of IC 2. Connect a 470k resistor from this pin to pin 14, and a 10uF tantalum capacitor between pin 12 and pin 7. Connect the possitive lead to pin 12.

Check the operation of all switches, and that the relay operates for the duration indicated on the display. If you set the display to 00, the relay should not operate at all. Check that the numbers displayed increase as you rotate the switches clockwise.

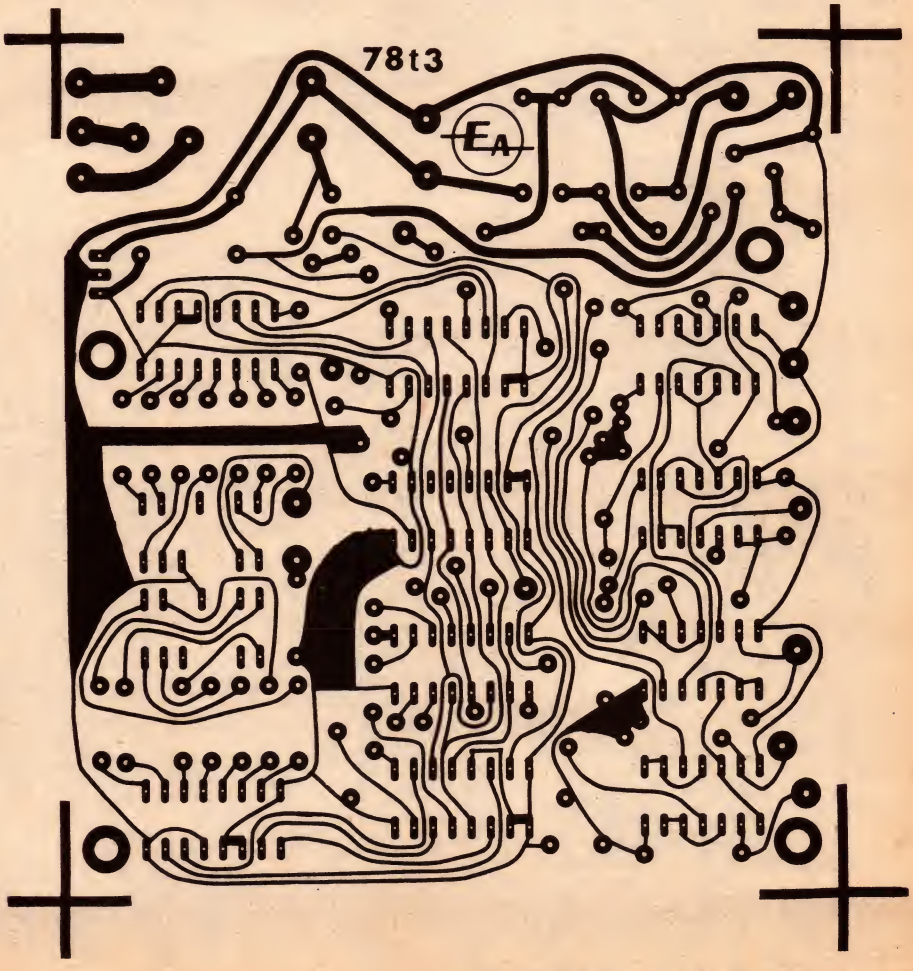
Any faults will most likely be due to construction faults, and in particular to faulty solder connections, or bridges across the tracks. If you encounter difficulties, use a logic probe or similar tool to trace through the circuit.

Once satisfied that all is correct, complete the connections to the relay, and try the unit with a lamp. The bezel for the display can be attached to the front panel with a suitable adhesive, or with double sided sticky tape, while the switches can be labelled with pressure sensitive lettering, protected with a coating of clear lacquer.

The maximum load which can be switched will depend on the relay contacts, which should not be over-rated. Typical relays which will suit the PCB are rated at about 1000W.



Above is a view inside the completed Photo Timer. Note the earth lead run to the metal front panel next to the mains on/off switch. Below is an actual size reproduction of the PC board.



Electronic door chime uses a microprocessor

Based on a dedicated microprocessor, this electronic door chime kit can be programmed to play any one of 24 different tunes at the flick of a switch. Why not build it as your first practical microprocessor project?

by GREG SWAIN

Although microprocessors have been around for a couple of years, now, practical projects incorporating them — at least as far as the hobbyist has been concerned — have been a long time coming! This project should change all that. It is the "Chroma-Chime" electronic door chime, designed by the British firm Chromatronics.

As purchased the unit comes only as a kit, intended to be put together at home by the hobbyist. In fact, all you need to successfully construct it is a soldering iron, a screwdriver, and the ability to follow an instruction manual!

The completed unit is housed in an attractive white plastic case designed for wall mounting. There are two clip-off access panels, the top one providing access to the battery compartment and to the doorbell and external speaker wiring terminals. (Note: an external speaker is optional; the unit's inbuilt loudspeaker should be sufficient in most cases).

Five operational controls are concealed below the lower access panel. These include two tune selector switches and the volume, speed and timbre controls. The desired tune is selected by simply setting the two switch controls to the appropriate alphanumeric code (eg G1 for Westminster Chimes).

The kit itself comes carefully packaged, and is complete to the last washer. Chromatronics even supply the wall mounting screws and solder! The only items not supplied as part of the kit are the doorbell pushbuttons and, of course, the batteries.

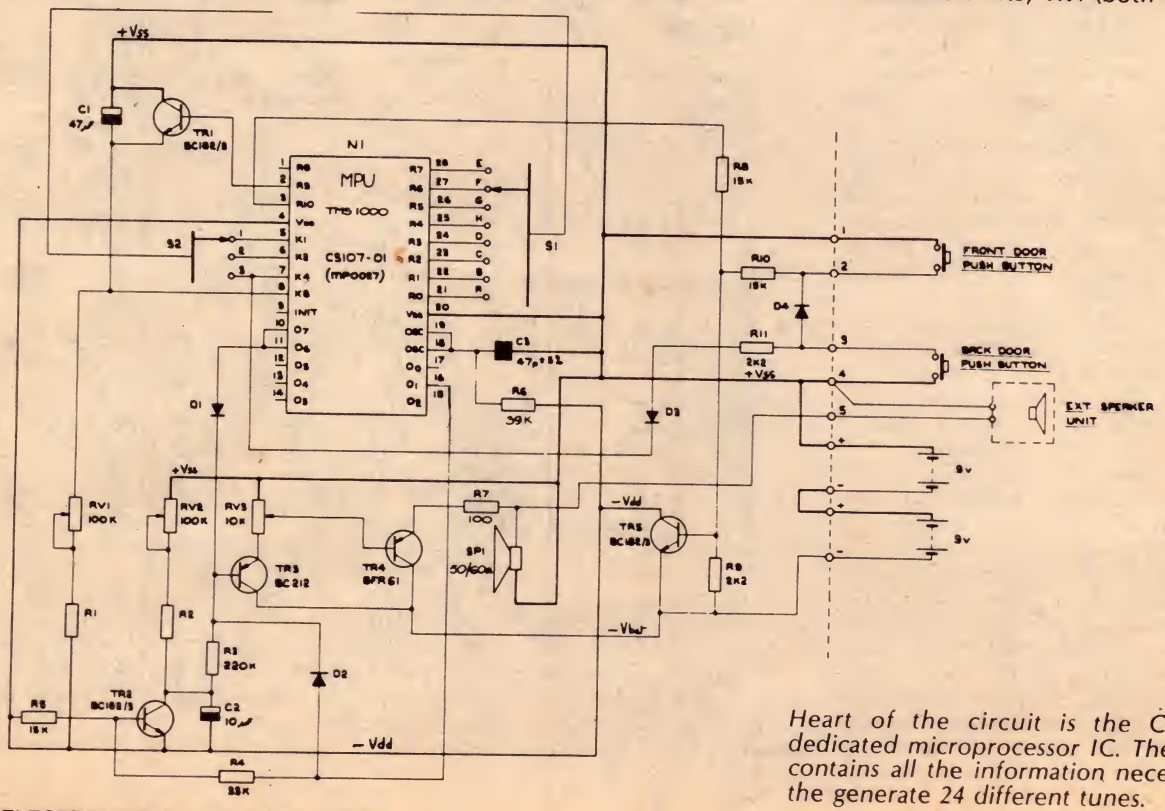
More on the kit later on. First, let's take a look at the circuit.

The dedicated microprocessor (MPU) chip used is the CS107/01 manufactured by Texas Instruments. It forms the heart of the design. Programmed into its inscrutable memory is all the control and timing information necessary for it to generate 24 different tunes. The notes necessary to produce the tunes are generated by counting down from the on-chip master clock.

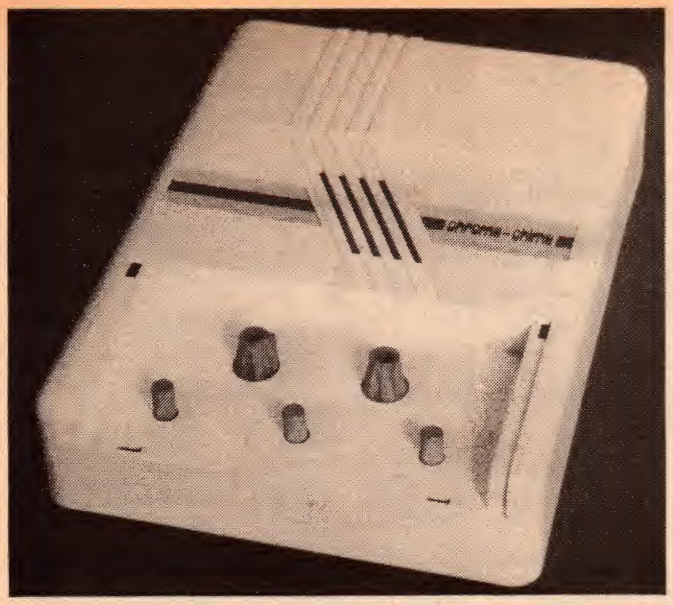
Because all notes are derived from the one clock they are given precise digital relationships, meaning that the unit cannot go out of tune.

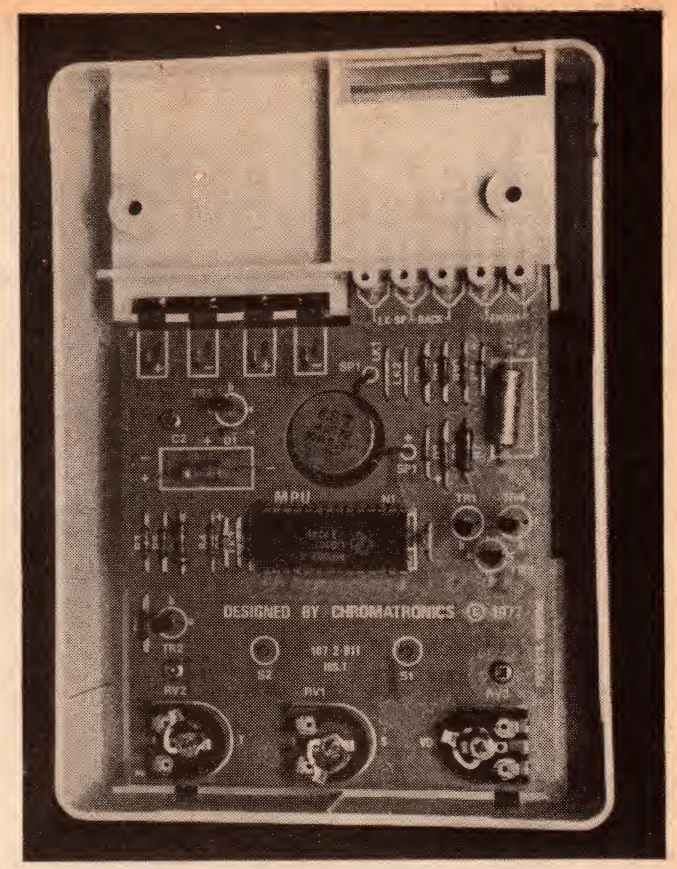
Power for the unit is supplied by two 9V batteries connected in series to give a nominal 18V supply rail. The current drawn from the batteries when the unit is in the quiescent state is less than 0.1uA, so battery life should be quite long (up to 12 months).

Transistors TR3, TR4 (both PNP) and



Heart of the circuit is the CS107/01 dedicated microprocessor IC. The device contains all the information necessary to the generate 24 different tunes.





At top is the completed unit, shown with the lower access panel removed to reveal the controls. View at right shows the assembled PC board mounted in the back of the case.

TR5 (NPN) are all connected directly to the negative supply rail and are normally turned off. The rest of the circuitry, including the negative input of the MPU, is connected back to the collector of TR5. In the quiescent state TR5's collector is high, and this ensures that TR1, TR2 and the MPU are held off.

When the front door pushbutton is depressed, TR5 is biased on by current through resistor R10. TR5 immediately saturates, causing the negative rail to be effectively connected to the MPU and subsidiary circuitry. When this happens, the MPU automatically initialises itself by resetting all internal registers and flags.

At the same time, the on-chip clock also starts up, to give a negative going sawtooth waveform of approximately 3V p-p at the junction of pins 18 and 19. The clock frequency is set by resistor R6 and capacitor C3, and is nominally 400kHz.

After the MPU has initiallised, its output at R10 (pin 3) goes high, causing the base of TR5 to be forward biased via resistor R8. This ensures that the circuit remains powered for the duration of the tune, even if the push-button contact is released.

Once the output at R10 has been turned on, the MPU proceeds to turn on each of its outputs R0-R7 in succession. Each time an output is turned on, the inputs to the device at K1, K2 and K4 (pins 5, 6 & 7) are sensed to determine if a direct connection exists due to the positions of the two selector switches S1 and S2. In this way, the MPU tests for one of 24 positions of the two switches; one for each tune.

The sequence of events differs somewhat if the back door pushbutton is pushed, however. Chip start up and initialisation are as before, except that the K4 input (pin 7) of the MPU is forced high via resistor R11 and diode D3. In this situation, the chip is programmed to detect the high input on K4 and to play tune B3 if A1 or A2 is selected, and tune A3 for selections other than A1 or A2.

The unit can thus be programmed to play a different tune for each door pushbutton.

The audio output of the MPU is derived from pin 10 (07), processed, and fed to a simple audio amplifier made up of PNP transistors TR3 and TR4. Waveform frequency from the MPU is in the form of a square wave varying between 200 and 550Hz, depending on which note is being played. Diode D1 ensures that TR3 and TR4 are held off during positive excursion of the 07 output.

During negative excursions from 07, the base of TR3 is pulled low by resistor R3. This level is set by the charge on C2, which generates the output decay function in company with R2 and RV2, the timbre pot.

Just before the commencement of each note, output 01 (pin 16) goes high, momentarily causing TR2 to be turned hard on. This completely discharges C2 so that the first few cycles of each note are always the loudest. As the note progresses, C2 commences to charge up via R2 and RV2, progressively turning TR3 off to provide an exponential decay.

Diode D2 prevents the base of TR3 from being pulled down during the discharge period of C2, to avoid any objectionable clicks which might otherwise be heard between notes.

The only aspect of the circuit that we haven't discussed so far is the job performed by TR1 and its associated components. Actually, this part of the circuit controls the timing of each note, and hence the overall playing time.

As each note is generated by the MPU, the R9 output (pin 2) is momentarily forced high, turning TR1 on and discharging capacitor C1. C1 then commences to recharge via the speed control knob RV1 and R1. As C1 charges the voltage on the K8 input (pin 8) gradually drops until the MPU senses a low level input at pin 8. R9 is then turned on again to repeat the cycle, which may be performed up to 16 times for an individual note.

Shorter notes, on the other hand, may only be given two counts in this manner, longer notes progressively more. The overall timing of the tune is thus entirely dependent on the time constant of C1 and RV1.

How does it all go together? In one word — easily!

Considering what the unit does, the total parts count is quite modest and construction incredibly simple. Just one IC (the MPU), 5 transistors, 4 diodes, 11 resistors, 3 trimpots, 3 capacitors, a loudspeaker, and associated hardware make up this kit. All the electronic

(Continued on page 109)

Build an eye-catching display unit

LED CHASER

Have you ever wanted to modulate strings of lights in the form of a chaser? If so, then read on, as this article is concerned with just that subject. In it, we give details of how a simple CMOS circuit can be used with a variety of power control devices.

by DAVID EDWARDS

Most people at one stage or another have seen those strings of lights, often arranged around some object that may be of interest, such as a display window or a ride at the fair, that flash on and off in such a way that an impression is given of movement along the string.

Originally, such displays were implemented with a mechanical commutator switch, rotated at a constant, low speed by a motor or clockwork mechanism. The commutator served to switch the lamps on in a set sequence, so that a visual impression of movement was created.

It was soon found that it was not necessary to switch all the lamps individually. In fact, by paralleling the lamps in a certain way, a much more interesting display could be achieved, while at the same time simplifying the required switching considerably.

It turned out that a completely satisfactory approach was to divide the lamps electrically into four groups, with lamps from each group connected in sequence — ABCD ABCDA and so on. This was very attractive electrically, as only four segments were required on the commutator.

Such a switching scheme is also very simple to implement using modern digital logic of course, and this is in fact what we have done. Fig. 1 shows the circuit required.

A 555 timer is connected in the astable mode, with the passive components chosen to give an oscillation frequency of about 7Hz. The frequency can be adjusted around this figure by means of the 10k trimpot.

The output of the 555 is used to clock two D-type CMOS flipflops connected as a two stage binary counter. The outputs of the counter are decoded by the four NAND gates, with the logic arranged so that each of the four outputs goes low in turn.

PNP transistors are used to buffer and invert these outputs, and can be used to drive a variety of loads. In Fig. 1, we have shown how they can be used to drive a string of series LEDs. In this case the circuit is most conveniently powered from a 9V battery, and the current limiting resistors have been chosen so that the total current drain of the circuit is about 20mA, made up of the 5mA required by the 555, and 15mA for whichever LED string is illuminated.

Fig. 2 shows how the outputs can be used to control power transistors, In this case, a 12V supply rail has been used, and the BC558 transistors have been replaced by BC327's which have a higher current rating. These are used to switch the SN3055's base current.

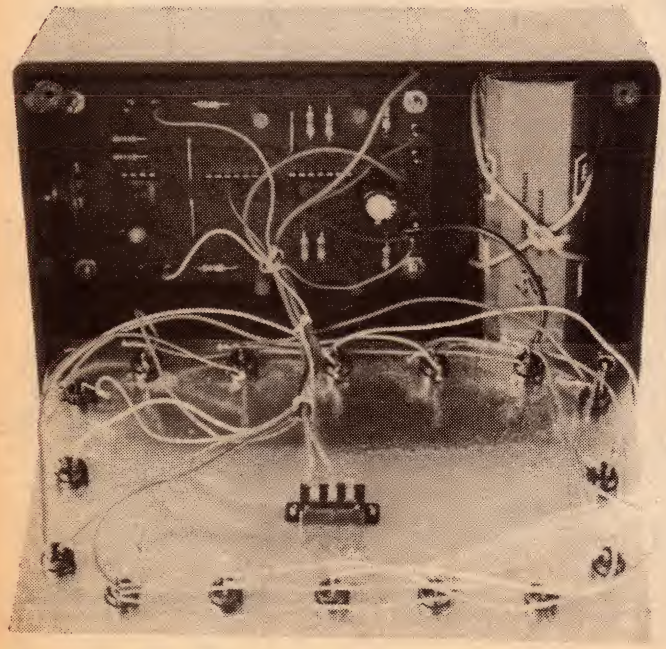
Each transistor can be used to control a maximum of 72W of power, or up to four 18W 12V globes.

Fig. 3 shows how a 12V relay can be controlled, again using a BC327 transistor. The two EM401 diodes prevent turnoff transients from damaging the transistor. With this circuit, the relay must have a DC resistance of greater than 22 ohms.

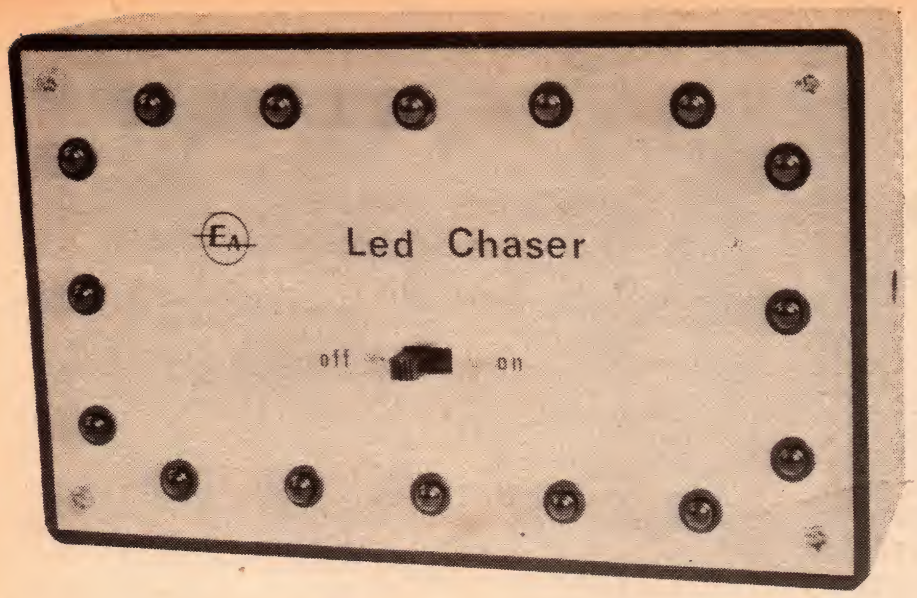
The maxium load which can be switched is determined by the contact ratings of the relay. With the circuits in Figs. 2 and 3, the maximum supply voltage which can be used is 15V.

In order to provide a demonstration unit, we constructed a small battery powered display. As you can see in the photographs, this consists of a small plastic box, around the circumference of which are mounted sixteen LEDs. When the power switch is placed in the "on" position, four LEDs spaced around the box illuminate, and appear to move around the loop of LEDs.

In order to simplify construction, all of the circuitry apart from the LEDs and



Use this photograph as a guide when you are assembling the components inside the case. Note how the battery is fixed in position with some scrap hookup wire.



PARTS LIST

SEMICONDUCTORS
1 555 timer
1 4013 dual D flipflop
1 4011 quad NAND gate
4 PNP switching transistors, BC558 or similar
16 red LEDs, with mounting clips

RESISTORS (all ¼W)
4 470ohm, 2 x 1k, 4 x 4.7k
1 10k trimpot (vertical mounting, 0.2" lead spacing)

CAPACITORS
1 100uF 16VW PCB mounting electrolytic
1 10uF 16VW tantalum electrolytic
1 0.01uF polyester

MISCELLANEOUS
1 printed circuit board, coded 78s3, 58 x 101mm
1 9V battery and clips to suit, Eveready 2362 or similar
1 plastic box, 160 x 96 x 50mm
1 miniature slide switch, with mounting screws
Solder, PCB pins, hookup wire, machine screws and nuts

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with high ratings may generally be used provided they are physically compatible.

the battery is contained on a small printed circuit board, coded 78s3. This board can also be used with the transistor and relay drivers, as it contains provision for the BC327 or BC558 buffer transistor and current limiting resistor.

Assembly of the board should be quite simple. Use the overlay pattern as a guide to the placement of components, and remember to orientate polarity-conscious components correctly. Mount the CMOS ICs last, and remember to solder their power supply pins first. In addition, your soldering iron bit should be connected to the earth pattern of the board.

We recommend the use of PCB pins for all external connections to the board. Perhaps the most difficult section of the construction is the wiring to the LEDs, so we will describe this in more detail. First mount the LEDs in the box, and then number them from 1 to 16, in order around the loop.

Wire the cathodes of LEDs 1, 2, 3 and 4 in parallel, and then connect the common cathodes to the earth pattern of the board. Then connect the anode of LED 1 to the cathode of LED 5, the anode of LED 5 to the cathode of LED 9, the anode of LED 9 to the cathode of LED 13, and the anode of LED 13 to output A on the PCB.

Similarly, connect the anode of LED 2 to the cathode of LED 6, the anode of LED 6 to the cathode of LED 10, the anode of LED 10 to the cathode of LED 14, and the anode of LED 14 to the out-

The circuit diagram of the chaser is shown below. Maximum supply voltage which can be used is 15V, due to the limitations of the CMOS devices.

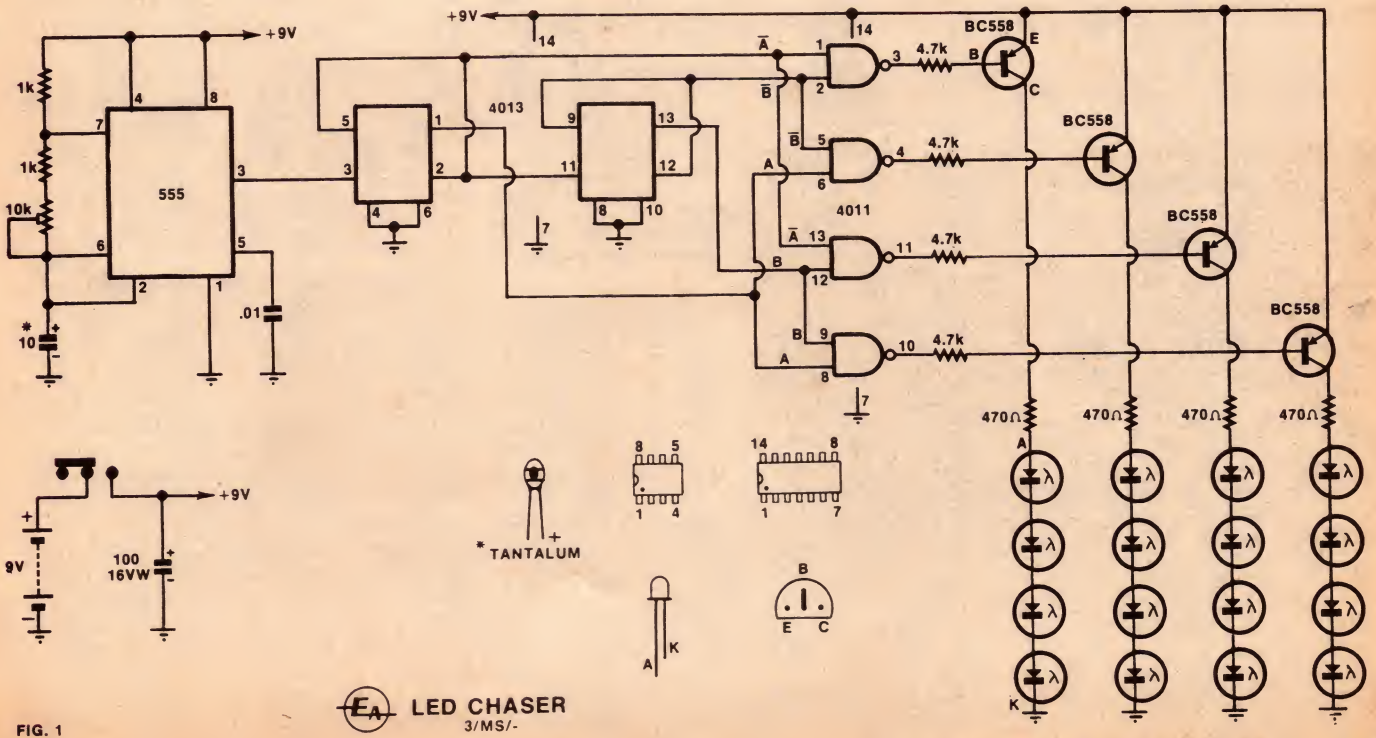


FIG. 1

LED CHASER
3/MS/-

Led Chaser

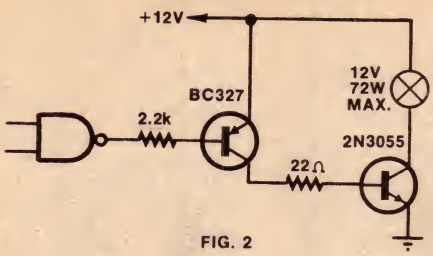


FIG. 2

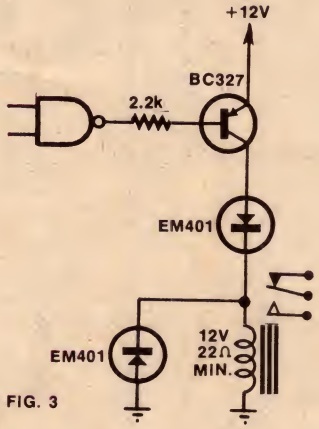
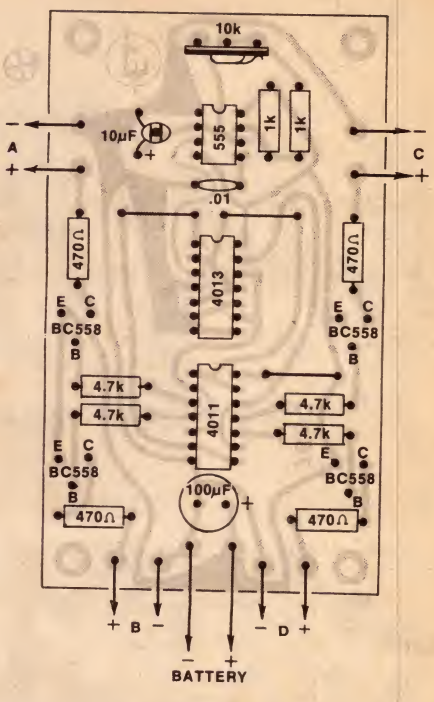
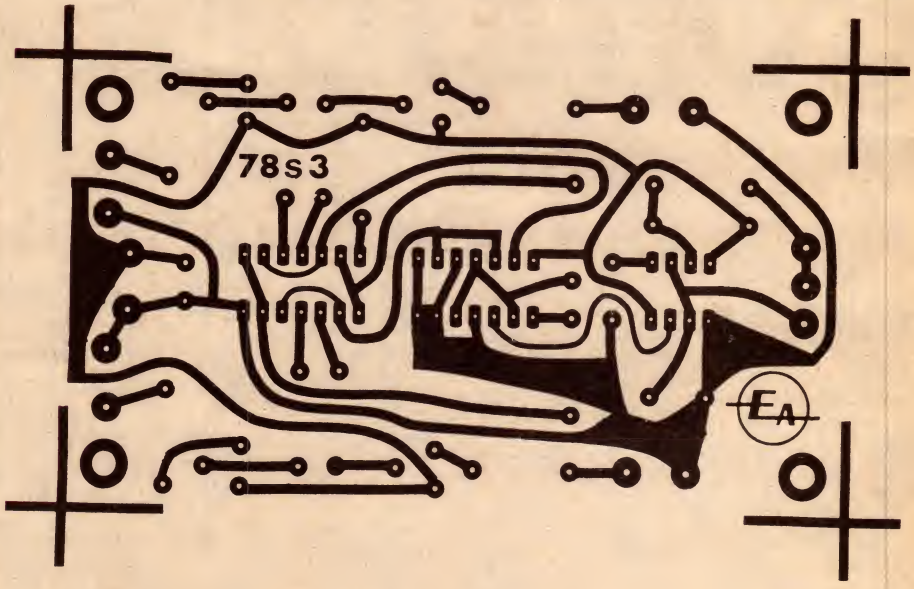


FIG. 3



BELOW: This full sized reproduction of the PCB can be traced or copied.

ABOVE: Use this diagram as a guide when you are inserting the components into the printed circuit board.



put B on the PCB.

The remaining LEDs are wired in a similar manner, so that only five wires are required between the LED array and the PCB. If it is desired to use more LEDs in the display, this can be achieved by increasing the supply rail. With a 15V supply rail, 8 LEDs can be connected in each series string.

Of course, the series resistor will have to be reduced by an appropriate amount. Further increases can be obtained by wiring a number of eight way serial strings in parallel, remembering of course not to exceed the current rating of the switching transistor.

The wiring schemes for use with the power transistor and relay switching schemes are broadly similar in style to the method used for the LEDs, and we will not describe them fully. The main thing to remember is that every fifth lamp should be on the one circuit, giving a total of four circuits in all.

SIEMENS

Distributors of Siemens electronic components

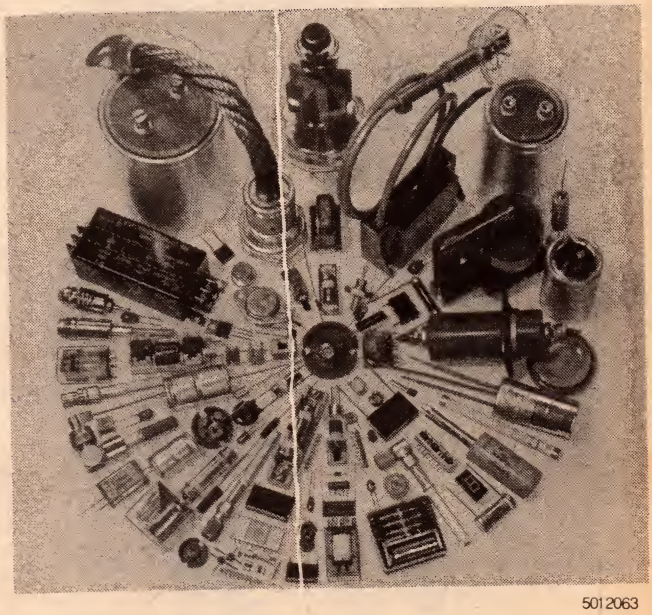
have now been appointed throughout Australia and New Zealand

Each distributor can supply the comprehensive range of Siemens electronic components at the same competitive prices as Siemens own Sales Offices.

Delphi Industries Limited,
26 Lagoon Drive, Panmure. Auckland 6 N.Z.
Phone: Auckland 574858
Electronic Components (Qld),
Suite 16, 205 Moggill Rd., Taringa. Qld. 4068
Phone: 3715677
R. G. Pank Pty. Ltd.,
230 Franklin St., Adelaide. S.A. 5000 Phone: 512411
Protronics Pty. Ltd.,
174-180 Wright St., Adelaide. S.A. 5000 Phone: 514713
Promark Distributors,
Suite 102, Wentworth House,
6-8 Clarke St., Crows Nest. N.S.W. 2065 Phone: 4396571
Reserve Electronics,
140 Loftus St., Leederville. W.A. 6007 Phone: 3283116

Siemens Industries Limited

Melbourne: 544 Church Street, Richmond, Vic. 3121. Ph. 429 7111
Sydney: 383 Pacific Highway, Artarmon, N.S.W. 2064. Ph. 439 2111
Brisbane: 294 St. Pauls Terrace, Fortitude Valley, Qld. 4006. Ph. 52 5071
Perth: 153 Burswood Road, Victoria Park, W.A. 6100. Ph. 361 8999



5012063

Siemens electronic components

A keyboard for your data terminal

In this article, the author describes how to add a keyboard and encoder, a 20mA serial interface, a VHF modulator and a power supply to the video display unit described in the February 1978 issue. Details are given showing how to use it as either a TV typewriter or a microprocessor-compatible video data terminal.

by DAVID EDWARDS

The video display unit PCB assembly described in the February issue accepts a 7 bit parallel ASCII coded digital word, and converts it into a standard video signal, suitable for displaying on a video monitor or surplus TV receiver. In order to use this assembly as either a TV typewriter or a data terminal, it is necessary to provide a keyboard and the appropriate encoder.

If you want to use a standard unmodified TV set for the display, a VHF modulator is also required. Similarly, a parallel-to-serial and serial-to-parallel converter is required for use with a microprocessor, so that signals can be passed to and from the VDU in standard 20mA loop format. This latter feature is not required for the TV typewriter.

The final requirements are a suitable power supply, and a case in which to enclose the separate assemblies. All of these additional requirements are described in this article.

The VHF modulator we have used is based on the modulator used for the video ball game described in the May 1976 issue. It is a self contained assembly, and will be described fully later in the article. All the remaining circuitry is accommodated on a single PCB, coded 78ut4, and measuring 121 x 132mm.

Referring now to the circuit diagram, we can discuss the various sections of the circuit.

The keyboard encoder is based on a National Semiconductor MOS LSI device, the MM5740AAF. This is a scanning type encoder, capable of dealing with up to 90 keyswitches arranged in an X-Y matrix. It provides for 7-bit ASCII encoding, with automatic code changing for shift and control modes.

The MM5740AAF scans all the keyswitches at a high rate, and when a key is depressed, it generates the appropriate code and makes it available at the data outputs, B1 to B7. At the same time a data strobe pulse is generated at the DS output, to indicate that a key has been pressed.

Two clock signals are required for the encoder, one a nominal 100kHz signal to drive the keyboard scanner, and the other a nominal 10Hz signal to implement the keyboard "repeat" function. These can both be derived from the main VDU board, thus saving the cost of two 555 oscillators as used in our previous VDU design (February 1977).

The outputs from the encoder use active-low logic levels, and thus require inversion using 7404 hex inverters. The inverter outputs are connected to the parallel inputs of the transmit section of the universal asynchronous receiver transmitter (UART), which then transmits them in serial form.

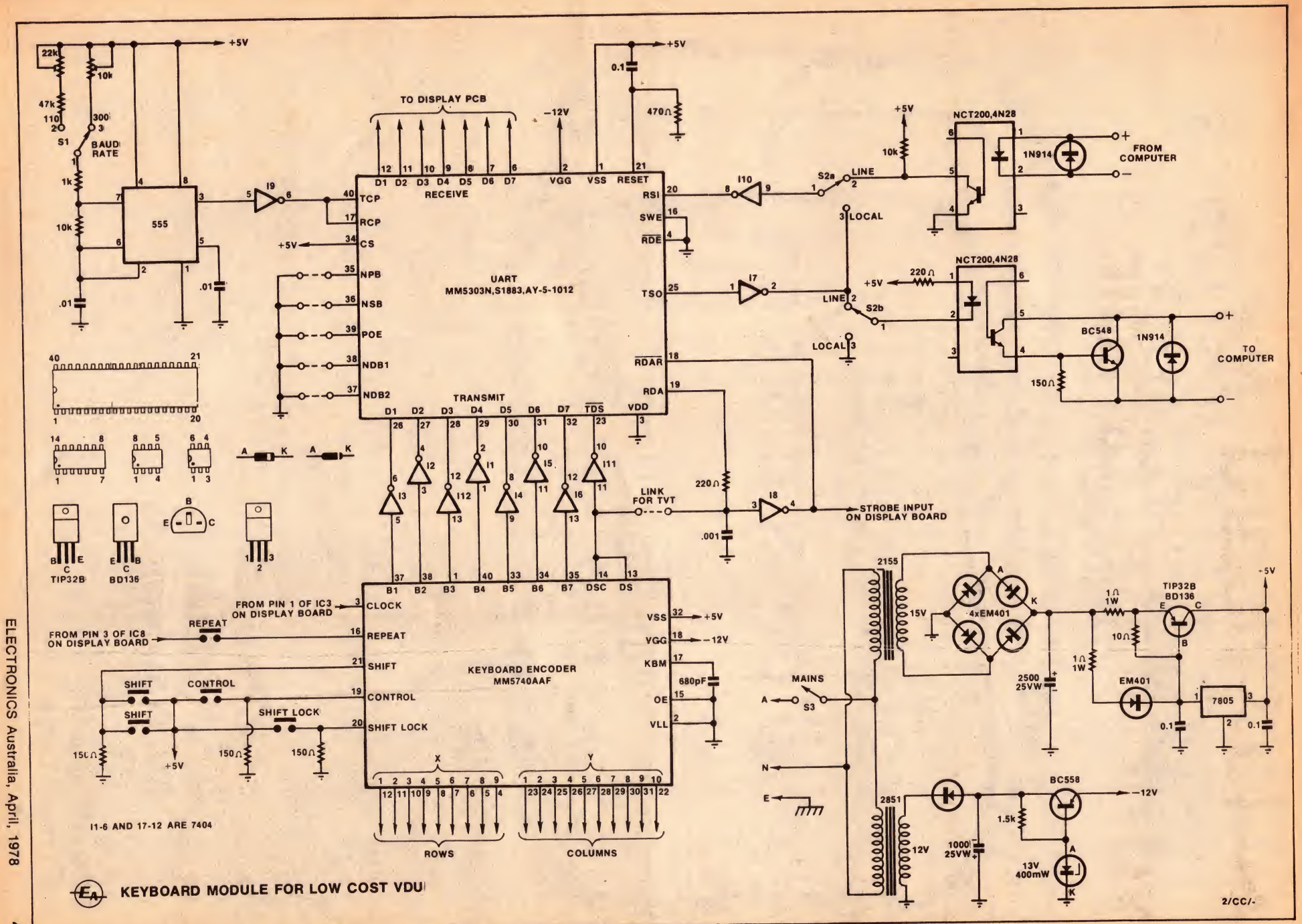
A 555 timer is used to generate the clock signals required by the UART. It is switch selectable for either a 110 or 300 baud communication rate, the two speeds being adjusted by preset pots.

Two optocouplers are used to buffer the serial input and output of the UART, to allow full isolation of the terminal from whatever system it is used with. The circuit used with the optocouplers is intended for use with 20mA current loops.

The receiver side of the UART is used to convert the serial signal returning to the terminal into the parallel signals required by the VDU board (D1 — D7). The receive data available (RDA) signal

LEFT: The way in which a small TV set sits on top of the chassis can be seen in this photograph.

On the page opposite is the circuit diagram for the keyboard encoder and the serial to parallel interface.



KEYBOARD MODULE FOR LOW COST VDU

from the UART is inverted and used to drive the strobe line of the VDU board.

Switching has been provided to enable the terminal unit to operate in either a "local" mode or a "line" mode. In the local mode, the serial output of the UART is connected directly to the serial input, allowing the unit to be used as a TV typewriter.

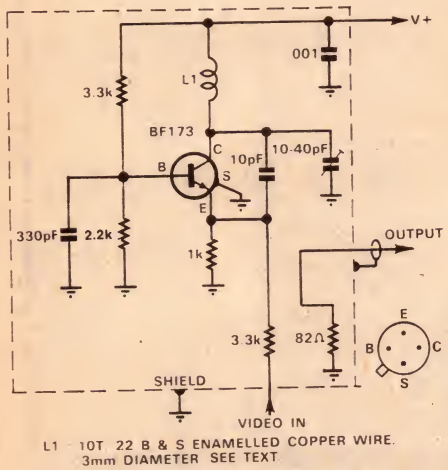
If the unit is to be used as a TV typewriter only, it is possible to dispense with the UART and its associated components. Only the keyboard encoder, the two hex inverters and the power supply components are required.

The power supply circuit is a little unusual. A total of 1.5A at 5V is required for the VDU board and the interface board, along with a —12V substrate bias supply. Two commonly available transformers are used rather than a single larger, and more expensive, unit.

The —12V supply is generated from a 2851 type transformer, with a simple active regulator to stabilise and regulate the output. The 5V supply uses a 2155 type transformer, with the regulation achieved by a three terminal IC regulator aided by a pass transistor.

With adequate heatsinking, this regulator is capable of supplying currents of up to 2A, but is limited in the present case by the transformer to just over 1.5A.

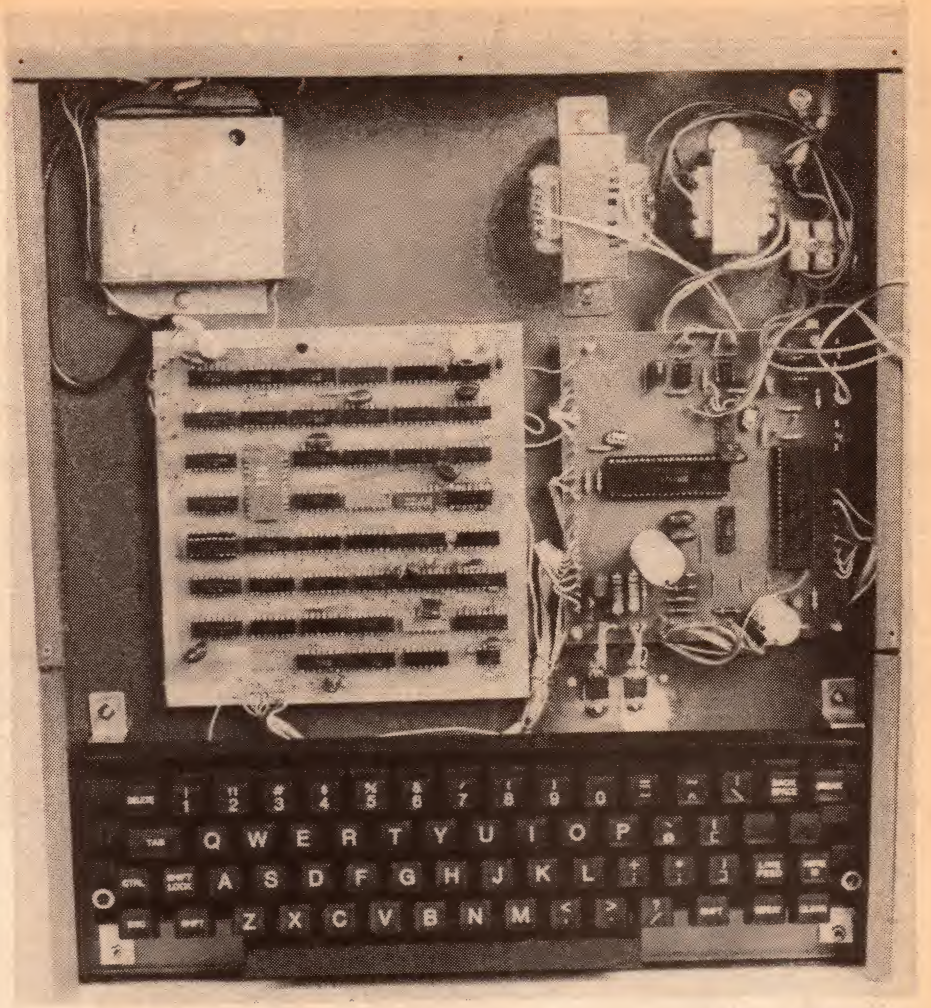
As stated earlier, the modulator used is based on one of our previous designs, and uses the same PCB. This is coded 76m5. All components are soldered to the copper side of the PCB, which is then bolted directly to the bottom of the case. A small tinplate shield is then fitted over the complete assembly, to minimise spurious radiation.



L1 10T 22 B & S ENAMELLED COPPER WIRE. 3mm DIAMETER SEE TEXT

EA VIDEO MODULATOR

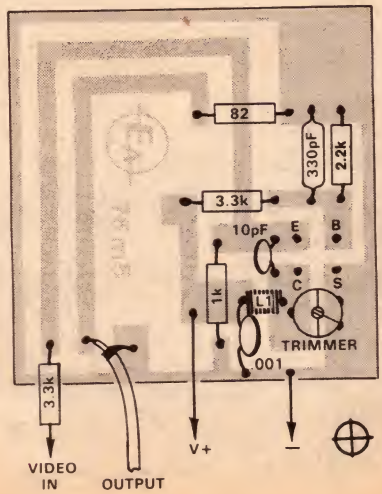
ABOVE and RIGHT: The modulator circuit diagram and overlay diagram. Note the transistor orientation.



This view shows how the keytops are arranged, and the internal layout of the unit. Note the modulator shield.

As can be seen from the photographs, the construction of the prototype is based on the metalwork and associated components used in our first video terminal, presented in the January and February 1977 issues.

The prototype case was kindly supplied by Cowper Sheetmetal and Engineering, of 11 Cowper Street, Granville, NSW 2142. It measures 360mm x 400mm 60mm, and has a sloping front with a cutout to match commonly available keyboards. The case is designed to allow a small portable TV or monitor to be placed on top, to form a complete video terminal.



The keyboard used in the prototype was supplied by Dick Smith Electronics Pty Ltd, and features gold plated contacts. It has most of the keytops required, apart from "carriage return". However two blank keytops are present, one of which can be pressed into service.

Commence construction by fitting the hardware to the case, using the photographs as a guide. The keyboard is mounted on two brackets, and should be fitted carefully so that all keys clear the cover cutout. Note that it may be necessary to extend the cutout slightly in the top right hand corner.

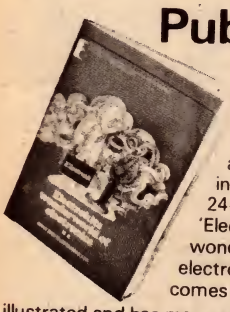
The two main PCBs are mounted on standoffs, immediately behind the keyboard. The transformers are mounted in the rear right hand corner, along with the associated mains wiring. The three miniature toggle switches are mounted on the lid of the case, just above the right hand side of the keyboard.

The modular PCB mounts in the rear left hand corner, near the two coaxial

HAPPY ANNIVERSARY-DAVRED

Yes, it's been a whole year since we issued our very first 'Electronic Component Catalogue' and boy, has our mail order department been busy!
Well, instead of getting, we're giving. That's right we're giving FREE BONUS GIFTS this month.

FREE 24-page Electronic Project Publication



When you send in your order just ask and we'll include FREE a 24-page copy of 'Electrokits wonder world of electronics! It comes fully illustrated and has many project circuits you can build with parts from your junk box or purchase the parts from us. Contains technical information and suggestions on building projects, with general symbols for many components.

FREE ADC MAGNETIC CARTRIDGE

when you buy the MP200 TAYA

TAYA MP200

Deluxe Manual Belt Drive Player If you want to replace that clapped out record-player you own now or want to start out with a Belt Drive this would have to suit you. Lightweight tone arm with magnetic cartridge tracking 2-3 grams, 300 mm alloy platter, 33⅓ and 45 rpm, screw-on cartridge holder for easy inspection or replacement and comes in walnut grain plinth complete with perspex cover.

Belt Drive

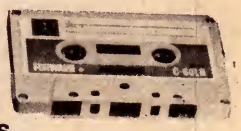
Similar model elsewhere ~~$139.95~~

DAVRED PRICE $89.65

(including FREE ADC Magnetic Cartridge)

FREE Tape Headcleaner Kit

Just what every tape owner needs. Kit containing 50 ml bottle of head-cleaning fluid and cotton buds to safely clean the head's surface. All this is a BONUS when you buy our **LASER C60 CASSETTE PACK.**



10 x C60 Cassettes
(plus free headcleaning kit)
Only $5.45 *Value*

Price $FREE for the asking

CRC SPECIALS

CRC 2-26

- ★ Improves electrical properties
- ★ Fights rust and corrosion
- ★ Dries and moistureproofs electrical equipment

16 oz Aerosol **$3.50**
6 oz Aerosol **$1.70**

CRC FREEZE

- ★ Provides instant cooling action for fault finding
- ★ Useful for testing thermocouple devices
- ★ Complete evaporation leaves no residue

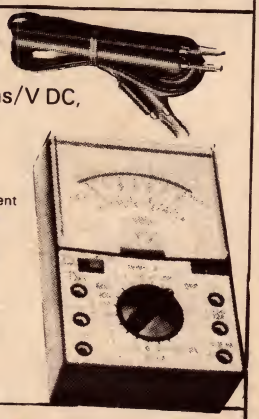
300 g Aerosol **$2.70**

MICROPHONE STANDS

Floor stands with solid base and standard thread to suit most microphones.

Only **$19.50**

Multitester



Model OT-2 20K ohms/V DC, 10K ohm/V AC

Specifications:
0-2.5, 10, 50, 250 and 1000V DC
0-10, 50, 250, 500 and 1000V AC
0-50uA, 25mA and 250mA DC Current
0-500, 5K and 50K ohms resistance

NORMAL PRICE ~~$29.50~~
Only while stocks last
$11.50

PERSONAL CALLERS

- **Plenty of free parking**
- **5 minutes from Newtown railway station. Come and browse!**

Mail Order Instructions
Minimum P + P $1.00
Orders over $9.99 must include additional postal charges (see right).

ADDITIONAL POSTAL CHARGES

Order value	Charge
$5 — $9.99	Nil
$10 — $24.99	$0.50
$25 — $49.99	$1.50
$50 — $99.99	$2.50
$100 or more	$4.00

Stop Press

Prices valid till 31st May or stocks expire.

Semiconductors

All top quality — no manufacturers surplus many for C.T.V. Stock up now.

AA143	10c	EQB01-152	38c
AC125	95c	E5386	14c
AC126	66c	IN2069	14c
AC128	75c	IN4002	4c
AC187	80c	IN4003	5c
AC188	85c	IN4005	8c
AC187-01	65c	IN4006	8c
AC188-01	58c	IS44	6c
AD149	$2.20	IS188	4c
BC107B	24c	IS1658	20c
BC108B	24c	IS2091	12c
BC108C	24c	IS2092	12c
BC109B	24c	IS4008A	16c
BA148	18c	IS4039A	16c
BA182	16c	IS4051	16c
BB105	28c	IS5009A	65c
BC146	25c	IS5020A	65c
BC183L	15c	IS5027A	64c
BC183LB	15c	IS5039A	65c
BC183LC	20c	IS5051A	70c
BC184B	10c	IS5075A	85c
BC184C	10c	IS5091A	65c
BC213B	12c	IS5120A	70c
BC637	20c	RA-1Z	9c
BC682L	20c	S34	16c
BD116	20c	SIB02	8c
BD135	32c	SIB04	8c
BF271	20c	SV04	25c
BF594	12c	SP835	80c
BF595	12c	TI54	15c
BF694JR	35c	TI55	20c
BFR40	20c	TI57	30c
BFR80	20c	TIC226D	80c
BFR81	18c	TD15M	48c
BFT43	45c	TIL107	$1.00
BFW30	$1.40	TIP29A	77c
BSW66	90c	TIP30A	88c
BU105	$4.95	TIP31A	91c
BU108	$4.25	TIP32A	95c
BU126	$3.45	TIP33A	$1.27
BU208	$4.20	TIP34A	45c
C103-Y	60c	TIP35A	$2.20
CM4-53A	16c	TIP 36A	$3.06

DAVRED ELECTRONICS PTY. LTD.

104-106 King Street Newtown Sydney Australia P.O. Box 317 Newtown, N.S.W. 2042.
THE NEW BREED IN ELECTRONICS SERVICE Telephone 516-3544

connectors. It is bolted to the case using a single machine screw and nut, which must pass through the earthy pattern.

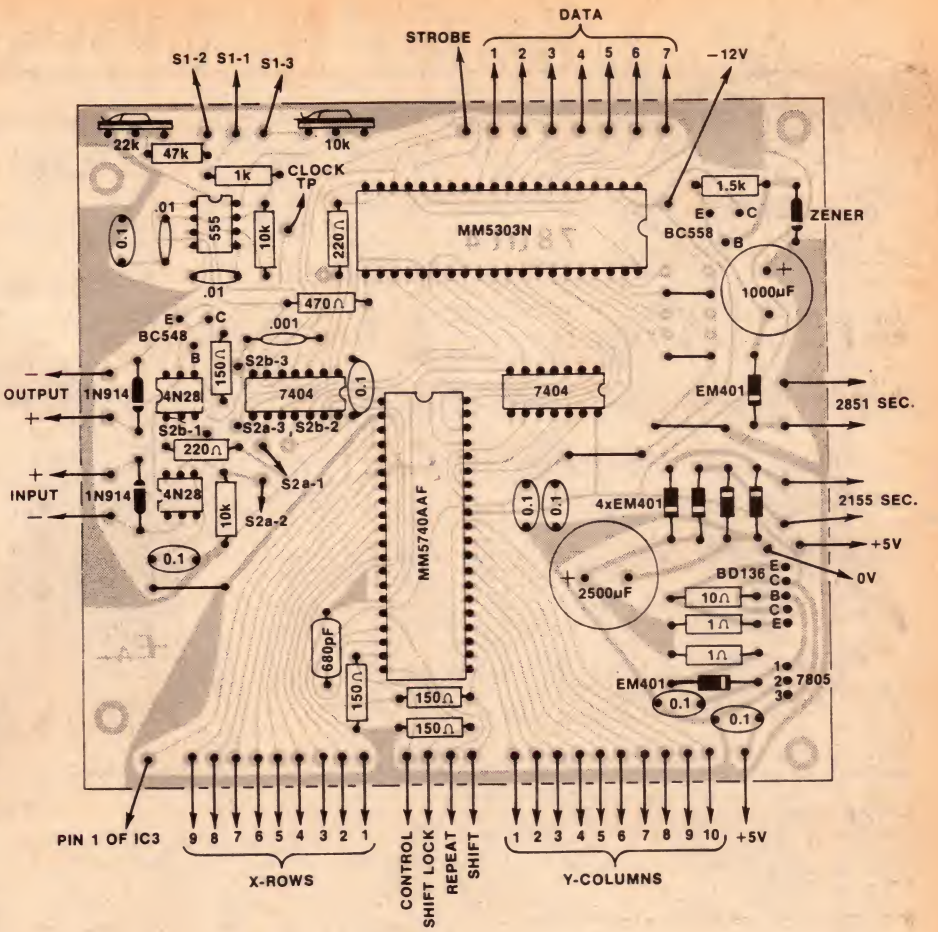
Once all the hardware is complete, the PCBs can be assembled. If you use sockets for the two 40 pin devices on the keyboard PCB, make sure they are of good quality. Sockets should not be necessary for the TTL ICs, the 555 or the optocouplers. We recommend that PCB pins be used for all external connections.

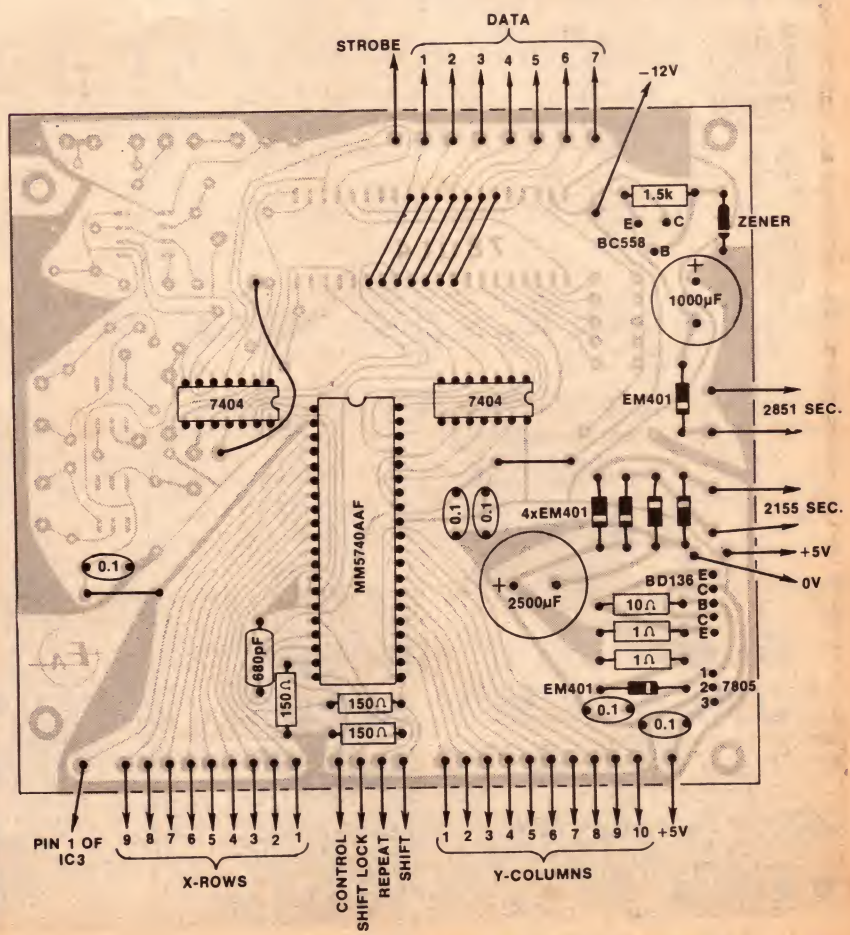
The three-terminal regulator and the pass transistor must be mounted on the base of the case, to provide adequate heatsinking. Use steel wool or emery paper to clean the paint off, to improve thermal conductivity, and use silicone grease if possible. The pass transistor must be insulated from the case, using the appropriate mica washer and insulated bush.

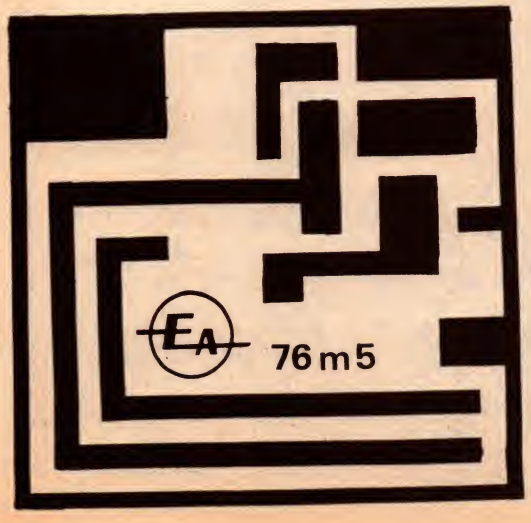
Note that the base connections of the two transistors specified are different. The BC136 mounts as shown in the overlay diagram, while the TIP32B mounts to the three lower holes of the group of five.

Before commencing to wire the keyboard, ensure that all the keytops are in the correct locations. Then wire the eight X rows and the 10 Y columns, using the keyboard wiring diagram as a guide. Use tinned copper wire, with insulation sleeves where crossovers are required. Use a small soldering iron, and do not heat the contacts unnecessarily, as the plastic of the switches may distort and upset the switching action.

ABOVE RIGHT: Use this overlay diagram if you are building the complete terminal.
RIGHT: Use this overlay for the TV typewriter-only version.
BELOW: This is the PCB pattern for the modulator, shown actual size.







ADDITIONAL PARTS REQUIRED FOR DATA TERMINAL

SEMICONDUCTORS
1 MM5303N, S1883, AY-5-1012 or similar UART
1 MM5740AAF keyboard encoder
2 7404 inverters
1 555 timer
2 4N28, NCT200, TIL114 or similar optocouplers
1 7805 5V three terminal regulator
1 BD136, TIP32B or similar PNP transistor
1 BC558 or similar PNP transistor
1 BC548 or similar NPN transistor
2 1N914 or similar silicon diodes
6 EM401 or similar silicon diodes
1 13V 400mW zener diode

RESISTORS
(all ¼W unless stated otherwise)
1 10k trimpot
1 22k trimpot
2 1 ohm 1W, 1 10 ohm, 4 150 ohm, 2 220 ohm, 1 470 ohm, 1 1k, 1 1.5k, 2 10k, 1 47k

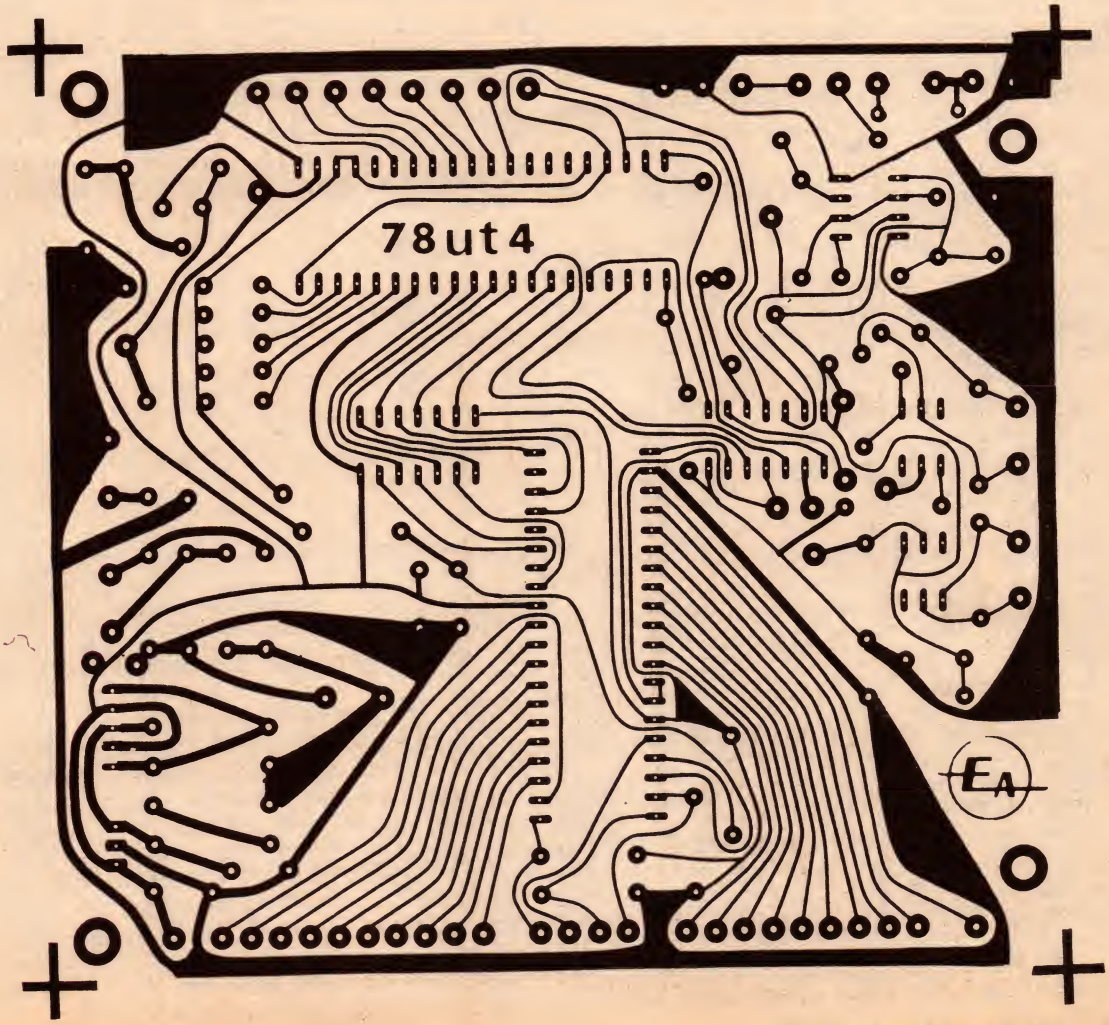
CAPACITORS
1 680pF polystyrene
1 0.001uF polyester
2 0.01uF polyester
7 0.1uF polyester
1 1000uF 25VW PCB electrolytic
1 2500uF 25VW PCB electrolytic

MISCELLANEOUS
1 printed circuit board, coded 78ut4, 121 x 132mm
1 ASCII-type keyboard assembly (see text)
1 Case, 400 x 360 x60 mm with sloping front (see text)
2 SPDT miniature toggle switches
1 DPDT miniature toggle switch
2 40 pin DIL sockets
2 Belling-Lee RF connectors
1 Output connector (see text)
1 Transformer, 240V to 15V @ 1A, DSE2155, A&R 2155 or similar
1 Transformer, 240V to 12V @ 150mA, DSE 2851, A&R 2851, PF 2851 or similar
8 PCB standoffs
4 rubber feet
1 Mains cord, 3 pin plug, grommett, cord clamp and terminal block
Rainbow cable, tinned copper wire, shielded cable, hookup wire, solder, machine screws and nuts, insulated mounting kit for plastic power transistor, silicon grease (heat sink compound)

ADDITIONAL PARTS REQUIRED FOR MODULATOR
1 Printed circuit board, coded 76m5, 65 x 65mm
1 BF173 NPN transistor
1 82 ohm, 1 1k, 1 2.2k, 2 3.3k ¼W resistors
1 10pF NPO ceramic capacitor
1 0.001uF ceramic capacitor
1 10 — 40pF trimmer capacitor
1 330pF polystyrene or ceramic capacitor
1 tinplate shield (see text)
22 B & S enamelled copper wire

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used provided they are physically compatible.

BELOW: This is the PCB pattern for the encoder board, shown actual size.



Complete the connections to the encoder board using rainbow cable, being careful to connect the right pads to the right rows or columns.

The signal for the repeat key is obtained from IC8 on the display board. This is the 555 timer which determines the cursor flashing rate. In order to provide a more acceptable repeat rate, R12 can be reduced from 120k to 33k.

The clock input to the encoder IC is obtained from pin 1 of IC3 on the display board. Run a flying lead between the two boards.

Connect a shielded cable from the video output of the display board to the video output socket on the rear panel, and a second shielded cable from the modulator output to the remaining coaxial socket. The input to the modulator is taken directly from the collector of the video output transistor (T1) on the display board, via a 3.3k series resistor. Extend the resistor leads with tinned copper wire, so that they will reach the distance.

The remaining connections can all be made with rainbow cable. An eight way cable is required between the display board and the encoder board, as well as a three way cable for the power supplies.

Once construction is complete, the unit can be tested. Connect the modulator output to a standard TV set, and switch on. Adjust the trimmer capacitor so that a signal is obtained on a vacant channel. This adjustment is fairly coarse, and it may be necessary to adjust the fine tuning of the TV set.

Then adjust the trimmer capacitor on the display board, (if one is fitted), to obtain a steady display on the screen. You should not need to alter the horizontal and vertical hold controls, however the brightness and contrast may need to be adjusted to obtain the most readable picture.

At this stage the display should be filled with characters at random, with a flashing cursor on the bottom line. Operating the clear keyswitch should clear the screen, and a carriage return should return the cursor to the bottom left hand corner. Note that these tests should be carried out in the "local" position.

Now exercise the keyboard, and check that all keys function correctly. Any errors will most likely be due to incorrect wiring of the keyboard, or a transposition error in the cable leading to the keyboard or the cable between the encoder board and the display board.

In order to set the baud rates to the correct values, you will need either a frequency counter or a correctly operating microprocessor system. If you have access to a frequency meter, set the clock frequency to 1760Hz for the 110 baud rate, and 4800Hz for the 300 baud rate.

If you only have access to a microprocessor system, switch to "line", and program it to send strings of characters. Then simply adjust the trimpot for the appropriate baud rate until the terminal correctly decodes the characters.

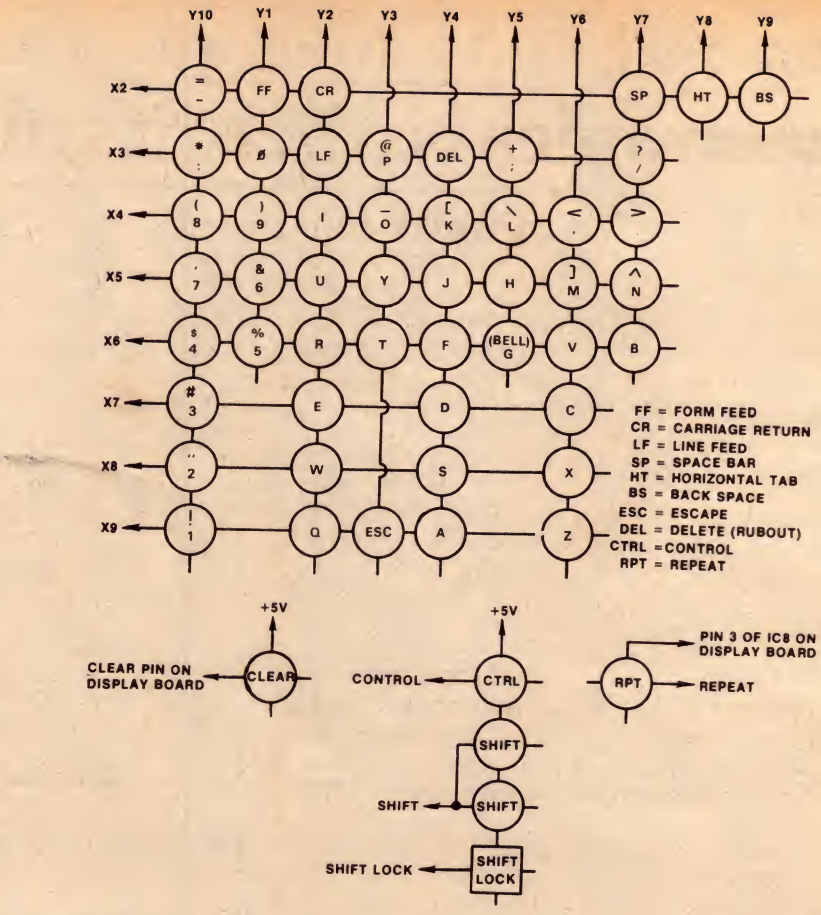
If you wish to use the unit only as a TV typewriter, wire in only those components shown on the appropriate overlay diagram. The only setting up adjustments required in this case will be the modulator frequency and the display unit clock frequency.

Finally, some comments concerning the video display board described in the February issue. In order to achieve fully reliable operation, several small component changes are required.

C10 should be increased in value to 470pF, while C12 should be reduced in value to 33pF. If modifying an existing board, it may be satisfactory to simply interchange C10 and C12.

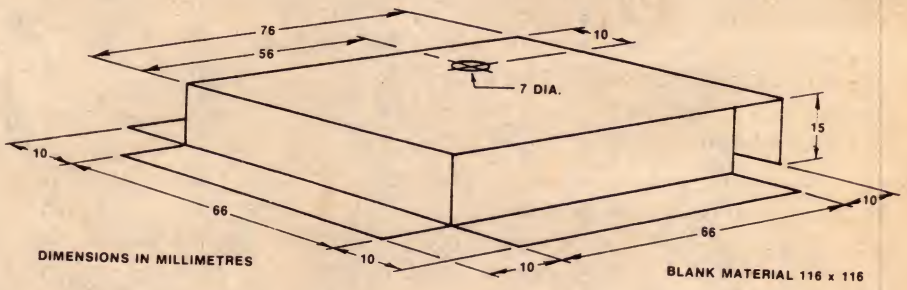
A 0.001uF capacitor should be fitted between pin 2 of IC21 and pin 7 (earth) of IC21. This will remove small glitches from the output of the comparator IC37, which may cause faulty character deposits into the memory.

It may also be necessary to fit 0.001uF capacitors between pins 6 and 8 of IC15 and earth (pin 7 of IC15), to remove possible glitches at these points.



ABOVE: The keyboard wiring diagram. Check first that the keytops are correctly positioned.

BELOW: The modulator shield, which can be cut from a 116mm square piece of tinplate.



Electronics is where it's all happening

...if you're into it you've got it made!

It's the world's fastest growing industry... with new discoveries...new products every day. And, every day, there are more jobs...bigger salaries...better opportunities...for people who are trained.

You can be part of this boom **now** by training with International Correspondence Schools. Learn to design, build, install, test, control and maintain modern electronic equipment...from your own colour TV or hi-fi set to a digital computer.

Your career opportunities are limitless...in broadcasting, industry, the military, aerospace programs, medical science and communications. With your enthusiasm and ICS tuition, a well paid job and a secure future in electronics is well within your grasp.

How do I get into it? ICS have put together a FREE Electronics Career Folder. It tells you all about the many courses open to you including Communications and Broadcasting, Industrial Electronics, Computer Servicing and Audio/Radio Servicing...courses endorsed by the Television and Electronics Technicians Institute of Australia. Post the coupon and the career folder will be on its way to you without obligation. Don't wait another minute...progress won't. The big developments in electronics are happening now and the demand for skilled people is growing all the time.

Special Colour TV repair course.
Colour TV is booming all over Australia, beyond the expectations of all the manufacturers, resulting in a shortage of qualified people to fill the service gap.

You could make a successful career in this growing field with the help of the ICS School of TV Servicing. You can benefit by this course – all you need is the enthusiasm to learn and enjoy rewarding work.

Your ICS course could be a start of an exciting new career or you can use your new-found knowledge to earn extra money in your spare time.

This special course is endorsed by the Television and Electronics Technicians Institute of Australia.

Send the coupon today. It could be the first step in an exciting new future for you.

Find out how you can be where it's all happening – in Electronics. Fill in the coupon and post today!

ICS Home Study ...your passport to success in life!

Your invitation to join the thousands of successful ICS graduates.

To: International Correspondence Schools
400 Pacific Highway, Crows Nest. NSW. 2065
18-20 Collins Street, Melbourne VIC. 3000
182 Wakefield Street, Wellington. N.Z.

274.680

YES!

Please send me, entirely without obligation, a copy of the:
☐ ICS Electronics Career Guidance Kit
☐ ICS Colour TV Servicing Career Guidance Kit.

MR/MRS/MISS _____

ADDRESS _____

_____ POST CODE _____

PRESENT OCCUPATION _____ AGE _____

Take the first step – Fill in and mail this coupon today!

ICS

PKB54430

The Serviceman

First aid for an ageing B & W set — and its owner!

One of the less pleasant aspects of our modern society is the increasing frequency with which expensive appliances are being "knocked off", not only from factories and stores, but from individual homes. My first story this month was the result of just such an incident.

It involved what appears to be the most negotiable of modern appliances at the present time; the colour TV set. The victim was an old customer — correction; a customer of long standing, (he is not as old as I am!) and he was considerably shaken by the experience.

It was not only that he had lost a much prized 26in. colour set, though that was bad enough. It was made worse by the fact that the thieves had entered the house during the night, while he and his family were asleep, and calmly carried the set out the back door.

The thought of strangers roaming freely around the house, while its occupants are asleep, can be very disconcerting. Suppose some member of the household had awakened and disturbed them; would they have turned violent?

I am glad it was his experience and not mine.

(Even so, when I related the story to Mrs Serviceman, she insisted that we tighten up our own security — a deadlock in place of the old back-door bolt and some revision of our long-established habit of leaving windows open at night in unused rooms.)

Anyway, having unburdened himself, he came to the point of his visit. While the colour set was insured, and he had no doubt that the company concerned would do the right thing, it might take two or three weeks to straighten matters out; perhaps more if he was to negotiate for some make or model other than the one which had been stolen.

So he had dragged out his old 25in. black and white set, gathering dust in his workshop, set it up in the lounge room and hopefully switched on. Unfortunately, its performance wasn't very impressive. The first point he noticed was that it seemed to take an unusually long time to produce any picture at all and, when it did, it was, as he put it, "pretty wishy washy". Then, as an after thought, "And it was rolling a bit, too".

In fact, I remembered the set from the pre colour era: a G. E. model that had been very impressive in its day, with a near-rectangular 25in. picture tube and a neat walnut console. Too good to discard , it had been moved to a spare room, then to the workshop to serve as a second set. But members of the household, wanting to watch a show, gravited naturally to the colour set and the B&W model just never got used — and that isn't good for ageing electronic equipment!

I sensed that the owner was concerned about the likely cost of repairing the black and white set. Understandably, he was not anxious to spend a lot of money on something which would, most likely, be used for a couple of weeks and then be banished to the workshop again, and rarely switched on.

Knowing that he had a suitable vehicle I suggested that he could save on cost if he could deliver the set to the shop. Then I would have a quick look at it and not commit him for too much expense without further discussion. This suited him and the set was duly delivered a couple of hours later.

When I switched it on I realised what he meant; the picture struggled on to — rather than appeared on — the screen and, even then, was "wishy washy" or, to be more scientific, severely lacking in contrast and brightness. I noticed something else too; it was seriously overscanning horizontally, to the point where the first and last letters of long titles were completely lost.

These observations suggested a whole batch of possible problems, including low EHT for one reason or another, a sick (slightly gassy) picture tube, and loss of video gain somewhere between the aerial terminals and the picture tube drive. Other problems like the poor vertical locking and the tendency to frame buzz in sound might or might not stem from the lack of video gain.

First off, I took the back off the set, lowered the swing-down chassis, cleaned around the picture tube ultor and lead, and sprayed it with WD-40. Then I swung the chassis back up and did likewise with the entire line output and EHT circuitry, gently easing out the valves and spraying the sockets to defeat any corrosion build-up.

At next switch on, the raster looked somewhat brighter, although I was not certain to what degree I could credit my clean-up or improvement in the picture tube itself, from simply being turned on. Either way, I reckoned the picture would be watchable, if not brilliant, given adequate video drive. So that was the next thing to look at.

There could have been a problem either in the tuner or the IF system but, apart from somewhat scratchy rotor contacts, the tuner seemed to be behaving normally. Added to this was the fact that there was no sign of "noise" in the picture, which seemed to rule out the concept of a fully operative IF system vainly trying to amplify a signal from a faulty tuner. It was much more likely that the IF system was low in gain, resulting in very little signal and no noise either!

On this basis I went over the main circuit board, which is very accessable in this set, dusting it off, inspecting components, withdrawing the valves and spraying with WD-40. Five minutes later it looked virtually new but, alas, the picture was now so weak as to be barely discernable. So troubleshooting had to begin in earnest, and out came the appropriate book of circuits.

My very first measurement pointed up the trouble: the voltage on the screen of the 6EH7 first IF amplifier was precisely the same as on the supply line. Fairly obviously, the 6EH7 was drawing no screen current and, by inference, no plate current either, even though the heater seemed to be alight.

Suspecting the socket, I wiggled the valve — producing the immediate effect of a purple flashover inside.

Not surprisingly, a new valve brought up a fairly acceptable picture, which responded in the normal way to the vertical hold control.

(Curiously, the new valve did not draw much screen current either, but for a very different reason: the first valve couldn't; the second valve could but didn't, because of the AGC that was now being generated).

Fairly obviously, the original 6EH7 had a very slow air leak alongside of the pins and my earlier remark about the picture "struggling on to the screen" mirrored the struggle within the valve to cope with the invading air molecules. When I disturbed the valve in its socket, I accelerated the leak and that was that!

(If I am permitted a footnote in the middle of an article, these events preceded this epistle by a couple of weeks. In the meantime, the original 6EH7 has grown a white deposit inside the whole top of the envelope — a sure sign that it is now completely "gassy".)

What about the overscanning?

The service data reminded me that this G. E. set has no width control, as such, but the linearity coil can be peaked in two positions, the inner one giving less width than the outer position. Giving the threads a squirt of WD-40 to free them, I screwed the core in and set it on the inner peak. It reduced the overscan markedly, sharpened the picture and improved the contrast by simply reducing the effective "magnification" of the image.

A touch-up of the vertical picture geometry, a "squirt" into the volume control, and similar treatment of the tuner yielded a predictable and watchable picture, with just one remaining problem — frame buzz in the sound. With the aid of a digital voltmeter it was only a minute's work to re-peak the discriminator coil but the frame buzz persisted, varying with the nature of the picture.

Backing off the AGC preset markedly reduced the buzz but at the expense of available picture contrast, even with the main contrast control fully advanced. Obvious measures like changing valves in the sound IF system made absolutely no difference.

So, at this point, I rang the owner and told him of the position. So far, the involvement in parts and time had been relatively small (probably less time than it took to type out the story) and the result would be acceptable in the short term. If he wanted me to, I could spend more time in an effort to optimise picture and sound, but it was up to him.

No thanks. After having a good quality colour set, he couldn't generate much enthusiasm for black and white TV and he'd be quite prepared to settle for it the way it was. At least I hadn't tried to sell him a new picture tube!

So he duly collected the set, with the express hope that we would never have to repeat the exercise.

And, finally, a few words about the story in the accompanying panel. It was taken from a recent copy of the "Sydney Morning Herald", and provides an uncommon insight into electronic servicing behind the bamboo curtain.

While there are many aspects of the story worthy of comment — including the obvious one that there is always someone worse off than ourselves — the one that intrigued me most was the reference to the complications of job demarcation.

Maybe something was lost in the translation, but I cannot avoid a mental picture of one worker specialising in resistors, another in capacitors, and another — probably with a degree — in transistors.

In which case it would be easy to understand why servicing a set would be, to say the least, difficult. Do they work as a team, or does each check out his particular specialty? And if the latter, does he then submit a written report concerning the status of his components?

And who makes the final decision as to what is to be done? One could go on speculating indefinitely, but even these few sugestions are enough to make the mind boggle. Our system may not be perfect, but it has a lot of good points!

Happy end for faulty radio saga in China

from YVONNE PRESTON, in Peking

HAVING trouble with repairmen? Spare a thought for Comrade Yang Chih-hsin, a textile research worker from Shanghai, who bought a Peking-made radio for his sister in far away Tibet to keep her in touch with news from the big smoke.

Within two weeks of its arrival in Tibet in April the set had broken down. Mr Yang paid for it to be posted to Shanghai for repairs.

Over the next three months the radio made no less than six trips backwards and forwards from Shanghai to Tibet and still it did not work.

The cost of this exercise soon amounted to as much as the price of the transistor radio, and a desperate Mr Yang finally sent it back to the manufacturers in Peking.

He shortly received a not-too-polite letter from the factory comrades signed by the Revolutionary Committee.

"What on earth is wrong with the radio?" the letter demanded.

"Why couldn't the shop in Shanghai fix it?"

The letter went on to explain that assembling a radio was a complex job, there were many departments in the factory and job demarcation was very complicated.

"So we don't know what to do with your radio."

And, the letter added, Mr Yang would have to pay the postage for their letter and for any further communication from the factory.

Mr Yang admitted in a letter he then penned to the People's Daily that he did not know whether to laugh or cry on receiving this uncomradely blast.

"I give up," he wrote. The radio would simply have to serve as a "negative example."

But there was a happy ending. One morning last month, Mr Yang opened his door to find a group of people from the Peking radio factory's Communist Party Committee on the doorstep.

'Self-criticism'

There and then they made a "self-criticism", and presented him with a new radio.

The moral of that story can be gleaned from Mr Yang's letter of thanks to the People's Daily.

It was all due to the Central Committee of the party and to Chairman Hua.

"From now on," wrote Mr Yang, "I will bear Chairman Mao's teachings in mind and make every effort to realise the goal of surpassing the world's advanced level in the field of science and technology in the not too distant future."

It seems just a little unfair that it was the Peking radio factory comrades who enjoyed the free trip down to Shanghai, and not patient Mr Yang who got a trip to the capital.

DICK SMITH ELECTRONICS

AUSTRALIAN OWNED — AUSTRALIA WIDE

Besides our stores in Sydney (4), Melbourne (2), Brisbane and Adelaide, we have dealers right across Australia. Each dot on the map shows a major dealer — the ones listed below — most of whom stock a large percentage of our range. If we showed all our dealers on the map, including the ones who stock our CB and communications lines, there wouldn't be much area left on the map!

REGISTERED TRADE MARK

Trilogy Elec. Supplies	52 Princes Hwy, Wollongong, NSW Ph 83-1219.
Sound Components	78 Brisbane St, Tamworth, NSW. Ph 66-1363
Hitel HiFi	145 Queen St, St Marys NSW. Ph 623-4442
Don House Electronics	2 Merriwa St, Gordon NSW. Ph 498-1398
DGE Sales	44 Brown St, Newcastle NSW. Ph 69-1222
M&W Electronics	48 McNamara St, Orange NSW. Ph 62-6491
Double Diamond	18 Russell St, Goulburn NSW. Ph 21-5440
Greg McCartney	99 Fitzmaurice St, Wagga NSW. Ph 21-3044
Rivercom	9 Copeland St, Wagga NSW. Ph 21-2125
GCG Comms.	385 Mulgrave Rd, Cairns QLD. Ph 54-1035
The Elect. Hobby Centre	1168 Gold Coast Hwy, Palm Bch QLD. Ph 34-1248
Premier Sound	239 Musgrave St, Rockhampton QLD. Ph 27-4004
Sumner Electronics	97 Mitchell St, Bendigo VIC. Ph 43-1977
Aero Electronics	123A Bathurst St, Hobart TAS. Ph 34-8232
Tasmanian HiFi	87A Brisbane St, Launceston TAS. Ph 31-5815
Devon Electronics	45 Ashburner St, Devonport TAS. Ph 24-4216
A.E. Cooling	Eliz. Town Centre, Peoples St Bldg, Elizabeth, SA. Ph 255-9196
Hutchesson's Communic.	5 Elizabeth St, Mt Gambier SA. Ph 25-6404
Altronics	105 Stirling St, Perth WA. Ph 328-1599
BP Electronics	11 Duke St, Albany WA. Ph 41-2681.

HERE IS YOUR FREE COPY OF DICK'S 1978 ENTHUSIASTS CATALOGUE.

Remove the catalogue by grasping firmly and pulling out of the magazine. It's stapled separately from the rest of the magazine. Re-close the magazine staple for safety. Now you have your all-new catalogue. Happy reading!

If someone's beaten you to it, you can obtain a copy for yourself (a) by buying another copy of Electronics Australia (b) pinching someone else's copy or (c) sending Dick 75c to cover packing and posting and he'll send one.

DO NOT LEAVE CATALOGUE IN MAGAZINE. REMOVE IT NOW FOR SAFETY.

FOR THE THRIFTY (OR POOR) AMATEUR:

Building a 146MHz Ground Plane Antenna from oddments

Here are details of a basic ground-plane antenna for the 2-metre (146MHz) amateur band, which can be put together cheaply from hardware oddments. Apart from providing the appropriate dimensions, the article explains an impedance matching trick which is not commonly featured in amateur antenna literature.

by NEVILLE WILLIAMS

The basic ground plane configuration, itself, is very well known. It employs a nominal quarter-wave vertical radiator, normally connected at the lower end to the centre conductor of a low-impedance coaxial feed cable. The outer conductor connects to a number of "ground-plane" rods radiating horizontally outwards like the spokes of a wheel and each, again, a nominal quarter wavelength at the required operating frequency.

To function efficiently, not less than three ground plane rods are necessary but, equally, there is not much point in going beyond six. Practical VHF antennas most commonly employ four radials, dispersed at 90-degree angles.

A ground plane antenna has the advantage of being compact, particularly for 146MHz and higher, and is capable of being clamped directly to the top of an earthed metal pipe or other support. It is omni-directional, with an inherently low angle of radiation and is therefore well suited to VHF base station or transportable operation. While station operators frequently end up with more ambitious antennas (also larger and more expensive) most seem to have started out with a basic ground-plane type.

This article might never have been written, had it not been for a situation which obliged the writer to contrive a practical 2-metre antenna over a holiday weekend. The end result was sufficiently practical to suggest that others may care to follow suit, saving money in the process.

The starting point for a home-made ground-plane has to be some kind of insulator which will reliably support the vertical radiator — metal rod or tube about 480mm (19in) long. This has to be attached to something which will mount the radials (of about the same length) terminate the feed cable, and provide a means of locking the whole thing to the mast.

Fortunately, we were able to get our hands on a moulded base commonly used to mount 27MHz whips to cars. They normally come complete with a moisture resistant gasket under the top nut, a moisture-resistant washer underneath the moulding and a bottom bracket to clamp solidly below a metal panel. The one we used was produced by Mobile One Communication Systems, who tell us that it is available as a seperate item through their dealers. Similar units should be available in other brands.

Do-it-yourself literature describing amateur antennas often show insulators and elements mounted on open bracket-work on the assumption that, if the circuit impedance is around 50 ohms, rainwater and a few spider webs are not likely to cause significant losses! However, the writer tends to be rather more fussy than this, added to which there is good point in making sure that moisture cannot gradually seep into the unsealed end of the feed coax.

Accordingly, we searched the house and workshop for a likely looking tin, jar, pill container, etc, that might form a base for the antenna assembly. Finally the search yielded a stout cylindrical container that once had served as a shield for a microphone transformer. The rest followed fairly naturally, as indicated in the accompanying diagram.

The top lid was drilled and filed to take the bottom bush of the insulator and the under-bracket trimmed to fit neatly inside the lid. This done, we removed the brass centre bolt and carefully drilled a 1/8in hole down the centre for 7 or 8mm. Into this we dropped the end of a length of brass brazing rod, suitably burnished, and carefully soldered it in position, being careful not to run solder down around the threads. This provided the basic vertical radiator.

Next step was to drill four 1/8in holes through the top lid and body to mount the four radials.

To support the radials, we selected four 25mm x 6.4mm spacers, tapped ⅛in Whitworth. We drilled out one end of each and soldered into them exactly half of a standard brazing rod. Making sure that each was making good metal-to-metal contact with the lid, each was locked in place with a brass screw, with the provision of solder lugs under one of them, as shown in the drawing.

There is one fortuitous point about this method of assembly. Standard brazing rods are just tantalisingly short of a half wavelength (or two quarter waves) at 146MHz but, by mounting them on spacers on a housing, as shown, they work out just right.

The bottom lid was drilled and filed to take an S0239 socket, which was provided with a cork gasket to inhibit moisture penetration. Two short leads had to be juggled into position and soldered before it was ultimately fixed in position.

To support the whole antenna assembly, we attached it to a metre or so of oddment curtain railing (not shown) which could then be slipped down inside the supporting water pipe. The antenna assembly could have been clamped to the curtain railing but we managed to bolt the two together before finally attaching the bottom lid.

Before finally erecting the antenna, we worked a smear of caulking compound around the lips of the lids and

BUILDING A 146MHz GROUND PLANE—cont.

gave it a generous overall coat of enamel paint, hopefully to seal the assembly and protect the screw holes, etc.

As a final gesture towards waterproofing, we planned to wrap the cable connection with plastic tape, exactly as would be done with a commercial antenna.

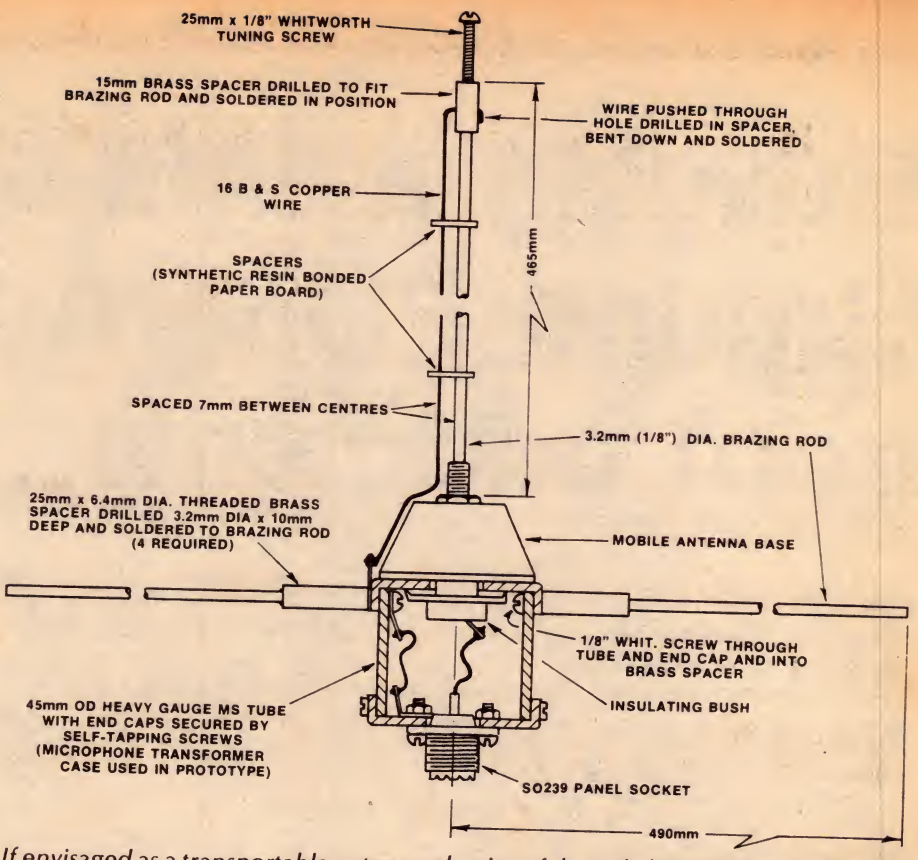
While not everyone will be able to lay their hands on something quite as convenient as our microphone transformer case, it is not too unreasonable to assume that resourceful amateurs will be able to come up with their own ingenious solutions — even at the expense of a lunch-hour "foreign order". The centre assembly does not need to be round, of course; a small rectangular metal box would be just as effective.

But now to get back to the details of the centre radiator. A basic ground plane antenna exhibits a natural impedance at resonance of about 30 ohms, which is too low to be a good match to any available coaxial cable. For a reasonable SWR, it has to be matched artificially to either 50 ohms or 70 ohms, preferably the former.

A number of tricks are possible, for example making the radiator deliberately longer or shorter than the resonant length by a selected percentage and inserting a series capacitor or a series inductor of just the right magnitude to cancel the resulting reactance. The extra component has to be accomodated, of course, and you have to get it right.

Another method is to attach a length of 50-ohm coaxial cable to the feedpoint of the ground plane, equal to an odd number (usually one) of electrical quarter wavelengths of cable at the frequency of operation. Having in mind the velocity factor of coaxial cable, a quarter wavelength of cable is about 33cm or 13 inches at 146MHz. This will act as a quarter-wave transformer, capable of matching the 30 approx. ohms of a basic ground plane to ordinary 70 ohm TV cable. While still practical, the fact remains that most modern tranceivers are designed for a 50-ohm load and cable.

Yet another trick is to bend the radials downwards, so that the antenna starts to look less like a ground-plane and more like a skirted dipole. As a result, its characteristic impedance starts to move from 30-odd ohms towards 70-odd ohms; a common rule of thumb suggests that around 50 ohms impedance is realised with the radials about 45 degrees below the horizontal. It is a simple trick but not always favoured, on the grounds that it produces mixed vertical and horizontal polarisation and a higher angle of radiation than a normal ground-plane.



If envisaged as a transportable antenna, the tips of the radials could be part threaded, and the spacers part drilled so that the radials could be screwed rather than soldered.

Thinking around the problem, it suddenly occurred to us to borrow a trick from the familiar folded dipole, the basis of most TV antennas. By using twin active elements, only one centre fed, the natural impedance is quadrupled to around 300 ohms. By using a ground-plane resembling half a folded dipole, with one element fed and the other earthed, a similar effect would be possible. But, since we wanted only a mild increase in impedance, the earthed conductor would need to be of lesser diameter than the 1/8in brazing rod.

As a bonus, we could expect an increase in bandwidth and therefore improved performance between the amateur band limits 144-148MHz.

To cut a long story short, it transpired that a length of ordinary 16 gauge wire in parallel with the brazing rod driven element did the trick. To hold it rigid, we cut two scraps of synthetic resin bonded paper board from a tagstrip and cemented them in place with a generous coating of 5-minute Araldite.

To be pedantic, our attempts to extrapolate from folded dipole graphs suggested that the parallel element should be somewhat thiner than 16 gauge, which should be kept in mind if you are limited to materials on hand. We settled for the 16 gauge on practical grounds: it was reasonably rigid and gave the required result.

In the process of establishing this, we also juggled the length of the elements to get resonance correct, having in mind that the effective length of the antenna includes much of what disappears down inside the supporting insulator.

We finished up with one of those ubiquitous brass spacers soldered over the top of the brazing rod, and with another small hole drilled through it to receive the end of the 16-gauge wire. The top threads were then available to receive an ordinary 1/8in Whitworth brass screw. Tuning the antenna then simply involved raking through the "bolts" tin and selecting the one which gave the desired resonance.

The end result was very gratifying. With the dimensions as shown, the SWR at the transmitter end of the cable read 1.1 from below 146MHz to above 147MHz. Beyond that, to 145MHz and 148MHz, it rose to about 1.2, and to a limit of about 1.3 in the seldom used region of 144MHz. Over the important region covered by the 1.1 SWR, the transmitter's internal metering and the SWR/Power meter showed very little difference between antenna on the far end of the cable and a resistive dummy load. Nor did either react to different lengths of cable.

We reckoned that was good enough.

In fact, unless we misjudge the position, that hastily improvised and "temporary" antenna will stay on top of the pole for quite a while to come, or until we get around to contriving something more ambitious!

GUIDE TO RESIDENTIAL POWER SUPPLIES

Listed below are the residential power supplies most commonly found in the principal countries throughout the world. The figures should be taken as a guide only and should be double-checked if equipment is to be imported from, or exported to, specific countries or states.

A possible source of further information is a publication "Electric Power Abroad" from the Bureau of International Commerce, USA. Apply to the Superintendant of Documents, US Government Printing Office, Washington DC 20402.

Residential power supplies are almost invariably AC and can usually be assumed to be so, except where DC is specifically mentioned. In the listing below, the frequency is shown first, invariably 50 or 60Hz, followed by the nominal supply voltage. The actual voltage may vary by a considerable percentage, depending on the nature and regulation of the source and the voltage drop along the supply mains.

Where two voltages are quoted in the ratio of about 1/1.7, it can be assumed that 3-phase reticulation is employed and therefore available to consumers, if required for high consumption equipment. Lights and small domestic appliances would operate at the lower voltage, single phase, eg. 240V in Australia.

Where the voltages are quoted in the ratio 1:2, the indication is that street distribution is in the form of single-phase, centre-tapped, a method frequently employed for less densely populated areas. Lights and small appliances would operate at the lower voltage, heavier appliances from the higher voltage.

A single figure indicates a simple, single-phase street main only.

Afghanistan	50, 220/380
Algeria	50, 127/220, 220/380
Angola	50, 220/380, 220/440 DC
Argentina	50, 220/380
Australia	50, 240/415
Austria	50, 220/380
Bahrain	50, 220
Bangladesh	50, 230/400
Belgium	50, 220/380
Bermuda	60, 115/230
Bolivia	50/60, 110/220
Brazil	60, 127/220
Bulgaria	50, 220/380
Burma	50, 220/440
Canada	60, 120/240
Chile	50, 220/380
Colombia	60, 110/220, 120/240
Costa Rica	60, 120/240
Cuba	60, 110/220
Cyprus	50, 240/415
Czechoslovakia	50, 220/380
Denmark	50, 220/380
Dominican Rep	60, 115/230
Ecuador	60, 110/220
Ethiopa	50, 127/220, 220/380
Fiji Islands	50, 240/415
Finland	50 220/380
France	120/240, 220/380
Gabon	50, 220/380
Germany (West)	50, 220/380
Ghana	50, 220/400
Greece	50, 220/380. Also DC
Guam	60, 110/220
Guadeloupe	50, 220/380
Guatemala	60, 110/220
Guyana	50, 110/220
Holland	220/380, 127/220
Hong Kong	50, 200/346
Hungary	50, 220/380
Iceland	50, 220/380
India	50, DC, 230/400
Indonesia	50, 127/220
Iran	50, 220/380
Iraq	50, 220/380
Italy	127/220, 220/380
Ivory Coast	50, 220/380
Jamaica	50, 110/220
Japan	50/60, 100/200
Jordan	50, 220/380
Kenya	50, 240/415
Khmer Republic	50
Korea	60, 100/200
Kuwait	50, 240/415
Laos	50, 220/380
Lebanon	50, 110/190
Liberia	60, 120
Libya	50, 127/220
Malaysia (Sarawak)	50, 230/400
Malta	50, 240/415
Mauritius	50, 230/400
Mexico	60, 120/208, 127/220
Monaco	50, 127/220
Morocco	50, 115/220
Mozambique	50, 220/380
New Caledonia	50, 220/380
New Guinea	50, 240/415
New Zealand	50, 230/400
Nigeria	50, 230/415
Norway	50, 230
Pakistan	50, 230/400
Panama	60, 115/230
Paraguay	50, 220
Peru	60, 220
Philippines	60, 110/220
Poland	50, 220/380
Portugal	50, 220/380
Rumania	50, 220/380
Saudi Arabia	50/60, 230/415, 120/208
Singapore	50, 230/400
Spain	50, 127/220, 220/380
Sri Lanka	50, 230/400
Sweden	50, 127/220, 220/380
Switzerland	50, 220/380
Syria	50, 115/200
Tahiti	50, 127/220
Taiwan	60, 110/220
Thailand	50, 220/380
Trinidad W.I.	60, 115/230
Turkey	50, 220/380
U.K.	50, 240/415
U.S.A.	60, 120/208, 120/240
U.S.S.R.	50, 127/220
Venezuela	50/60, 120/240
Viet Nam	50, 127/220
Yemen	50, 220
Yugoslavia	50, 220/380

A white and pink noise generator

. . . build it and check out your hifi system

Built around a single noise generator IC, this handy device is capable of generating both "white" and "pink" noise. It can be used to check the response of your hifi system, for testing loudspeakers, or for setting the response on a graphic equaliser.

by GREG SWAIN

White noise and pink noise are terms that describe a complete mixture of all frequencies in one signal, They differ only in terms of the relative amplitude of each frequency. White noise is characterised by equal energy per bandwidth. In other words, there is an equal amount of energy between 100 and 200Hz as between 200 and 300Hz, or 1000 and 1100Hz.

Pink noise, on the other hand, is characterised by equal energy per octave. Since an octave doubles the frequency, this means that there is an equal amount of energy between 20 and 40Hz, 40 and 80Hz, 80 and 160Hz, or 640 and 1280Hz. This is why pink noise can be used to set up an octave equaliser, whose controls follow this doubling pattern. More about this later on.

In practice, it is not difficult to derive pink noise from white noise. Since white noise has equal energy per bandwidth, and since the bandwidth per octave doubles, the use of white noise produces the energy per octave. We can thus derive pink noise by passing white noise through a filter that will reduce the response by 3dB per octave.

Why would we want to generate noise in the first place? After all, noise is usually seen as something which interferes with wanted signals. However, there are occasions when the characteristics of noise can make it very useful.

One useful characteristic of white noise is that it consists effectively of a mixture of an infinite number of signals at different frequencies. It may thus be used as a test signal for measuring the frequency response of such things as electrical filters, loudspeaker systems, amplifiers and transmission lines.

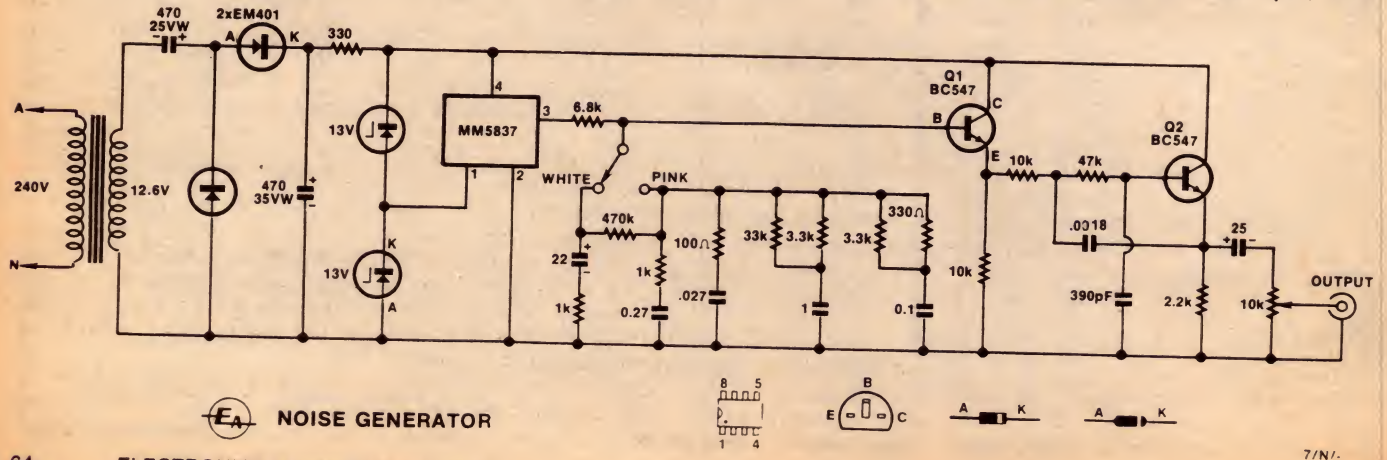
With the noise source fed to the device under test, the response may be measured using a tuneable narrow-band filter and an RMS reading voltmeter connected to the output of the device. A good quality microphone with a known frequency response would also be required when testing loudspeakers.

A second useful characteristic of white noise is that its instantaneous amplitude varies randomly over a fairly wide range. As a result, a noise signal can be useful in testing circuits and systems for their behaviour with signals of widely differing amplitude.

One interesting use of white noise is in the adjustment of tape recorder heads for correct azimuth, i.e. adjusting the gap to be at right angles to the direction of tape travel. By using a white noise test tape, it is quite a simple matter to set the head for correct azimuth by listening to the output, and adjusting the maximum "hiss".

Other uses of white noise include making sound effects and, when suitably modulated, simulating traffic noises, the sea, or a railway locomotive. A less trivial use is in the synthesis of the sound of musical instruments.

But for most enthusiasts, the greatest use of a noise generator is in setting up an audio system. For example, both



white and pink noise provide a means of subjectively comparing speaker systems. Noise fed in turn to systems arranged side-by-side for the usual A-B test quickly makes colouration differences apparent as a discernable change in the sound of the noise.

Such subjective evaluations can be particularly useful when designing a loudspeaker crossover network.

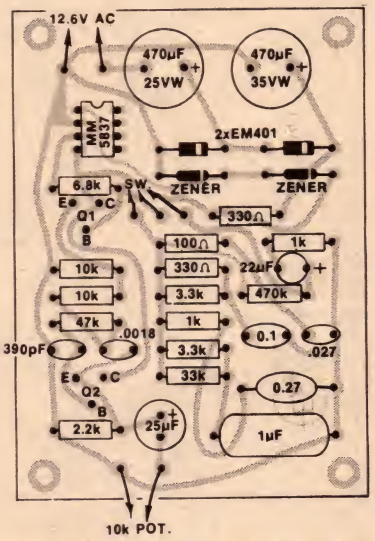
Again, in an audio situation, a noise generator can be a useful device for balancing channel output from a stereo system. Loudspeaker positioning in a room is often compromised by room furniture, and it is not always easy to find the correct channel balance on music signals alone. But the task is easy with a noise generator — just set the balance control for equal "hiss" from both channels.

So a noise generator can be a very useful device for setting up a stereo system and for many other applications. Accordingly, we have produced the simple instrument presented here. Let's talk about the circuit.

Heart of the design is the MM5837 noise generator IC from National Semiconductor. This is a MOS LSI device that generates noise digitally in the form of a long pseudo-random-binary sequence (PRBS), using a 17-stage shift register with feedback. The device is packaged in an 8-pin DIL plastic package, and features its own internal clock oscillator which typically runs at around 100kHz. This means that the resulting PRBS length of 131,071 bits repeats itself about every 1.31 seconds.

A simple RC filter network giving a slope of 3dB per octave is used to convert the white noise output of the IC into pink noise. This filter network is selectable by means of a single-pole 2-position toggle switch, and is made up of the 1uF, 0.27uF, 0.1uF and 0.027uF capacitors and their associated series resistors.

The series 22uF tantalum capacitor and 470 ohm resistor network act to attenuate the output signal level when



This overlay diagram shows the PC board as viewed from the component side.

the switch is in the white noise position. This is to ensure that average signal output for both white noise and pink noise will be roughly the same. The 470k resistor across the switch contacts is to reduce switching transients.

The processed signal from the MM5837 device is first buffered by transistor Q1 and then fed to a low-pass filter stage made up of transistor Q2 and associated components. The effect of this filter stage is to roll the response off rapidly above 10kHz. Signal level at 10kHz is —3dB with respect to 1kHz (white noise), and around—60dB at 100kHz. Filter slope is 12dB per octave.

The turnover frequency chosen for the active filter is a compromise between bandwidth on the one hand, and adequate filtering of the PRBS output of the MM5837 into analog noise on the other. The resultant white noise signal is virtually indistinguishable from "real" noise, and is close to "white" in its frequency distribution up to the filter turnover frequency.

PARTS LIST

1 metal case, 100 x 60 x 140mm
1 PC board, 92 x 66mm, code 78ng4
1 power transformer, 240V to 12.6V, at 150mA, DSE 2851, PF2851 or similar
1 10k linear pot
1 output connector as required
1 single-pole 2-position switch

SEMICONDUCTORS
1 MM5837 digital noise source IC
2 BC547 NPN transistors
2 EM401, BY126/50 or similar diodes
2 BZY88/C13V or similar 13V zener diodes

RESISTORS (½W, 5%)
1 x 100ohm, 2 x 330ohm, 2 x 1k, 1 x 2.2k, 2 x 3.3k, 1 x 6.8k, 2 x 10k, 1 x 33k, 1 x 47k, 1 x 470k.

CAPACITORS
1 470uF 35VW PC electrolytic
1 470uF 25VW PC electrolytic
1 22uF 25VW tantalum
1 22uF 25VW PC electrolytic
1 1uF polyester
1 0.27uF polyester
1 0.1uF polyester
1 o.027uF polyester
1 0.0018uF polyester
1 390pF disc ceramic

MISCELLANEOUS
Mains cord and plug, clamp, grommet, 2-way section of terminal strip, hook-up wire, solder, nuts and screws etc.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for the prototype. Components with higher ratings may be used, providing they are physically compatible.

A 10k linear pot allows convenient adjustment of the final output signal level to prevent overload of amplifier input stages. Maximum signal output is around 800mV p-p, which is more than adequate for high level input amplifier stages.

Construction of the unit should begin with assembly of the small printed circuit board. Coded 78ng4, and measuring 92 x 66mm, the board accepts all the generator circuitry except for the output pot and the power transformer. Just follow the component overlay diagram and leave the MM5837 device until last.

Since the MM5837 is a MOS device, handle it with the usual precautions during construction. When soldering it into circuit, earth the barrel of the soldering iron to the PCB earth track and solder the power supply pins (1, 2 and 4) first.

We constructed the prototype in a small utility case supplied by Dick Smith Electronics Pty Ltd. This case comes

with an aluminium chassis and a steel lid, and measures 100 x 60 x 140mm approx. (W x H x D). The general layout of components in the case can be seen from the photograph.

The mains cord enters through a rubber grommet at the back of the case, and should be securely clamped. The active and neutral leads are terminated in a 2-way insulated terminal block, while the earth lead is soldered to a lug secured under the cord clamp mounting bolt.

An RCA phono jack was used as the output connector, simply because this was convenient. There is no reason why other types of connectors could not be used instead, however, if you prefer.

When assembly is complete, apply power and check for correct operation. Any faults will most likely be due to incorrect wiring, or to misplaced components on the PC board.

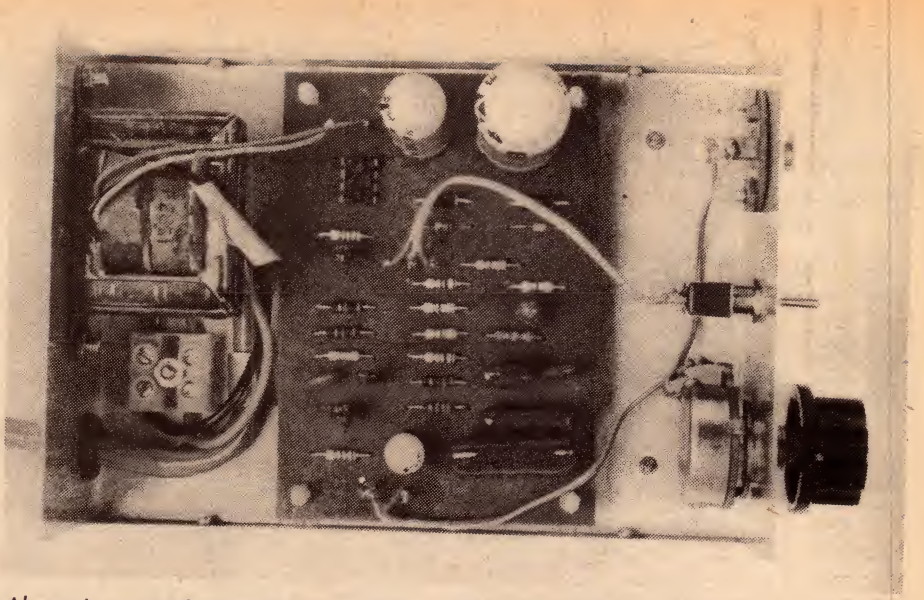
As mentioned earlier, a pink noise generator can be used to set the controls on an octave equaliser to match an audio system to room acoustics to achieve an overall flat response. By feeding a pink noise signal into an audio system, we can measure the overall response at each octave. If the system is flat, equal loudness is obtained from the bandwidth of each equaliser control.

The technique, then, is to feed pink noise through each pass band seperately and measure the output from the loudspeakers. A tape recorder with a microphone input and a record-level meter is the most convenient way of measuring the sound from the speakers.

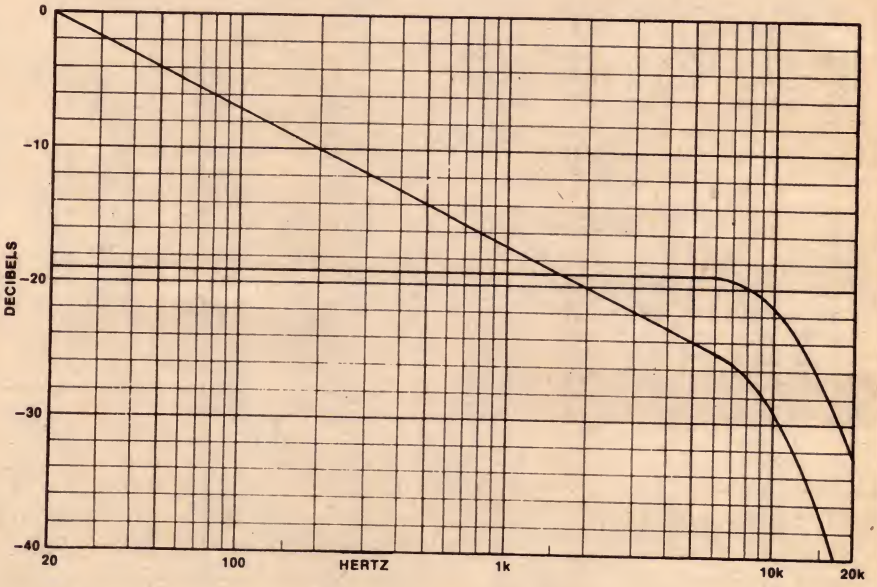
Since all controls are adjusted relative to each other, one control can be arbitrarily set anywhere. It is usually best to choose the middle control and set it to its centre or flat position. All other controls are set to their minimum positions. The microphone should be placed in the normal listening position and, with the pink noise source connected, the input level adjusted to 0VU.

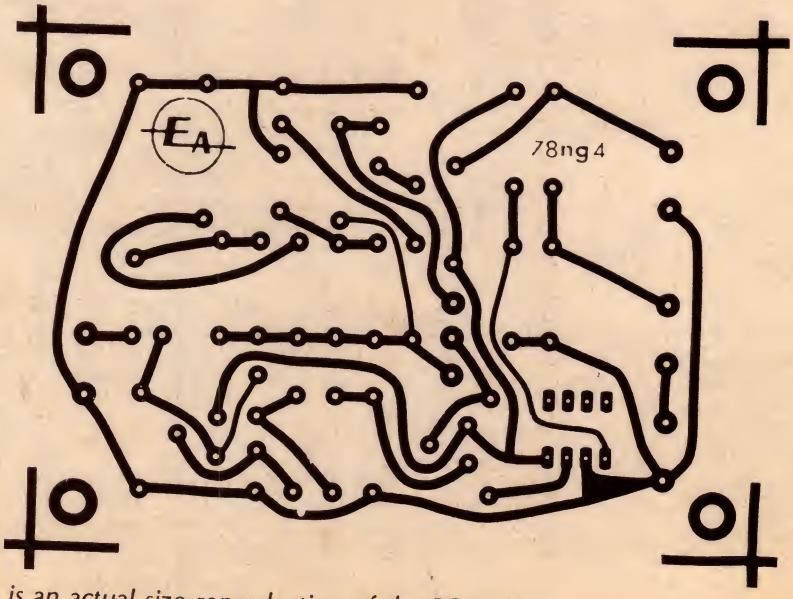
The middle control is then turned down and each of the other controls adjusted, in turn, for a 0UV reading. Carefully note the position to which each slider has to be advanced for 0VU. Once the position of each slider has been noted, the noise generator can be disconnected and the sliders placed in their respective positions. The overall response should now be flat.

Note that the overall accuracy of this proceedure depends on the frequency response of the microphone. If the response of the microphone is known, the appropriate corrections can be made.



Above is an inside view of the completed noise generator. The graph below plots the responses of the white and pink noise filters.





Here is an actual size reproduction of the PC pattern.

HEATHKIT

AUTOMOTIVE TUNE-UP INSTRUMENTS

Three-In-One Tune-Up Meter

Ideal for "Weekend Mechanics" or Pro's

SPECIAL $55.00

- *Pays for itself with just a couple of tuneups*
- *Helps you keep your car in top shape for best operating performance and efficiency*
- *Measures dwell, engine rpm and voltage on an easy-to-read colour coded 4½" meter*
- *Easy to use — just connect two leads to your engine*

Kit CM-1073, $55.00

Deluxe Timing Light

flashes brighter than daylight

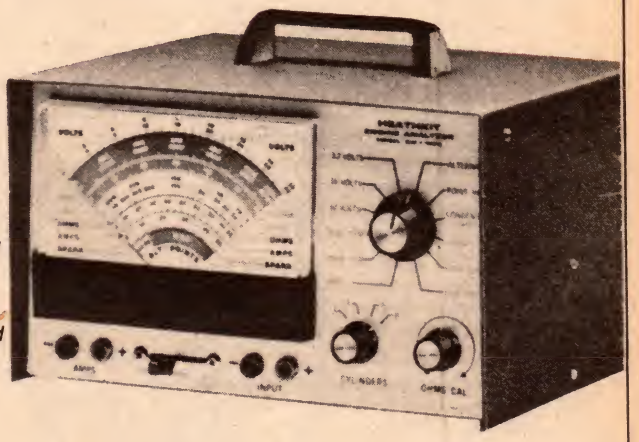
Helps you keep your car properly timed for better driving efficiency, cleaner running, smoother performance and increased gas economy. Features a handy inductive pickup that snaps directly around the #1 spark plug wire without removing wire, using adaptors, etc. (Recommended for GM-HEI and other systems, where high voltage may be present.) Has a super-bright xenon flash bulb that can be seen easily even outdoors. Can be hooked up while the engine is running, and won't interfere with other auto test equipment either. Comfortable pistol-grip handle, insulated blue-plastic housing. Polarity protected. Powered by your car's battery or a separate 15-volt supply. With all cables, pickup and clips.

Kit CI-1040, $65.00

Low-cost professional-grade Engine Analyzer

Shows dwell, rpm, amps, volts, ohms, spark output, alternator and point condition

- *Keep your car running like "new"*
- *Easy-to-read colour-coded meter*
- *Outstanding ±3% accuracy on all ranges*
- *Complete with all leads and accessories*



This professional-grade instrument performs the tests you need to tune up your car for improved performance and best fuel economy. Tests conventional, magneto, transistorized, and most capacitive discharge ignition systems — both positive and negative ground, any voltage, on any 3, 4, 6 or 8-cylinder engine. The CM-1050 Analyzer permits rapid testing and servicing of the storage battery, generator or alternator, voltage regulator, starter, distributor, ignition circuit (points, condenser and coil), accessories and all the electrical wiring. Easy to connect and use — makes home tune-ups a snap. The large 6" meter is colour-coded for easy reading. Unlike most other engine analyzers, there is no need to recalibrate the unit between functions — all you do is turn the rotary switch to the desired range and you're ready to test. Accuracy is ±3% on all settings, over a wide range of operating temperatures. Operates on 3 standard "C" batteries (not supplied). Has convenient carrying handle. Comes complete with all leads and accessories, ready to build quickly and use.

Kit CM-1050, $152.00

Exhaust Gas Analyzer

checks fuel efficiency— Shows air-fuel ratio and percent carbon monoxide

Monitors your car's exhaust for minimum air pollution and maximum efficiency by measuring thermal conductivity of the exhaust gases. Shows the air-fuel ratio, combustion efficiency and the percentage of carbon monoxide in the exhaust. The CI-1080 is essential when you're tuning up a car which must meet specific requirements for exhaust emissions, or when you simply want peak operating efficiency. Comes with all cables and tubing for easy connection.

Kit CI-1080, $110.00

ORDER BY COUPON NOW OR COME TO OUR SHOWROOM

Please rush me the kit of my choice. My cheque for $ is enclosed plus $2.50 for package and post.

Name .....

Address .....

..... **P/Code**.....

Send to: W. F. Heathkit Centre
220 Park St., South Melb. 3205. Phone: 699-4999

☐ Kit CM-1073
☐ Kit CI-1040
☐ Kit CM-1050
☐ Kit CI-1080

WF 516/77

Impulse tachometers and capacitor discharge ignition

Many readers have fitted capacitor discharge ignition to their cars only to find that the system is not directly compatible with an impulse tachometer. Here the author describes a simple driver circuit to enable an impulse tachometer to be used with CDI, and details a rather elaborate CDI unit used on a Mini 850 for racing.

by MARK REYNOLDS, M.E. (Hons.)*

Impulse tachometers are fitted to many cars as original equipment by vehicle manufacturers. These tachometers connect across the ignition coil primary and, as many readers have discovered, refuse to work if capacitor discharge ignition (CDI) is fitted to the vehicle. This situation applies to the CDI unit featured in July 1975 EA, and to other similar systems.

It turns out to be fairly simple to persuade an impulse tachometer to work properly with CDI, provided you accept the necessity to add a few electronic components, either to the CDI itself or in a separate little unit. Because of the great variety of circuits that could do the job, and the equally great variety of CDI designs, I will explain the simple theory so that interested readers can devise their own circuits to suit their installation.

Also described is a typical add-on driver circuit (which I hope will work, I haven't tried it), and this is offered to readers as a basis for trial. I will then move on to describe an elaborate CDI unit I have built which includes an internal impulse tachometer driving circuit. It does work, and very well.

* 22 Brennans Rd, Arncliffe, NSW 2205.

Finally, I have a few general observations on tachometers which may be of interest.

Let's begin with the theory. The factors that affect the operation of impulse tachometers are easily grasped if you remember that the pick-up loop on the back is really a crude little transformer. Thus the output signal is proportional to di/dt, the rate of change of current on the input. With a standard ignition system you are talking about a 3 amp current changing really very slowly, as electronic signals go. A typical coil rise time can be taken as about 80us.

You can get the same output signal — the tachometer works the same — if you hit it with only 300mA, but push the rise time down to 8us. It is easy to demonstrate this with any signal generator that has a low impedance square wave output. Couple the tachometer up through a load resistor and the tachometer will work. As a bonus, you will have just built yourself an accurate calibration rig.

If you can't find a suitably powerful signal generator, just use an audio amplifier driving an 8 ohm load. Remember to check the signal generator output on a digital frequency meter during calibration.

Well, that's all there is to it. The most

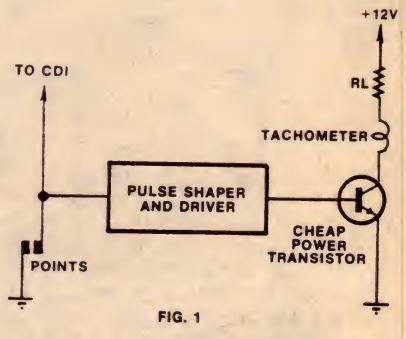


FIG. 1

straightforward way to obtain a fast-rising current source is shown in schematic form in Fig. 1. Now for various reasons I have always wanted to retain the normal 2 loops through the pick-up coil on the tachometer, so I use a current of 300mA — 500mA. However, if you are willing to use more turns of thinner wire, you can cut the transistor current correspondingly. Bring the current down to 80mA or so, and you are within the capabilities of a CMOS Schmitt trigger driving any cheap general purpose transistor.

Fig. 2 shows my suggestion for a driver circuit, but I emphasise that I haven't tried it. Bearing in mind the dust and dirt a car attracts, it's usually a good idea to fit the various components into the CDI case, or into the tachometer. The transistor can be any NPN device (negative earth only) with Icmax greater than or equal to 200mA and h_{FE} greater than or equal to 100 at Ic = 100mA. Suitable type numbers include 2N3704 or BC182B.

Those who wish to retain the normal 2 loops on the pick-up coil could use a Darlington output with a load resistor of 18 or 22 ohms.

Adventurous souls who object to wasting 5/6 of an IC might like to try paralleling all 6 Schmitt triggers in the 74C14, and driving the tachometer directly with about 15 turns of superfine wire on the pick-up coil. The possibilities are endless, so I'll move on to describe a special CDI unit I built and proved 2 years ago while in New Zealand. It includes a built-in impulse tachometer driving circuit which can be compared with the above suggestions.

This particular unit was inspired by motor racing needs and I don't pretend

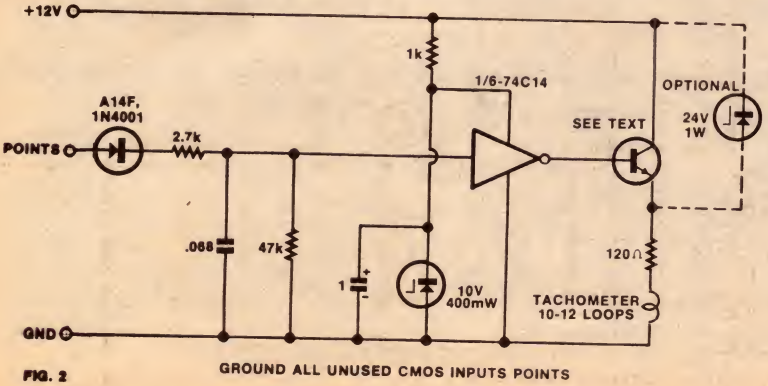


FIG. 2

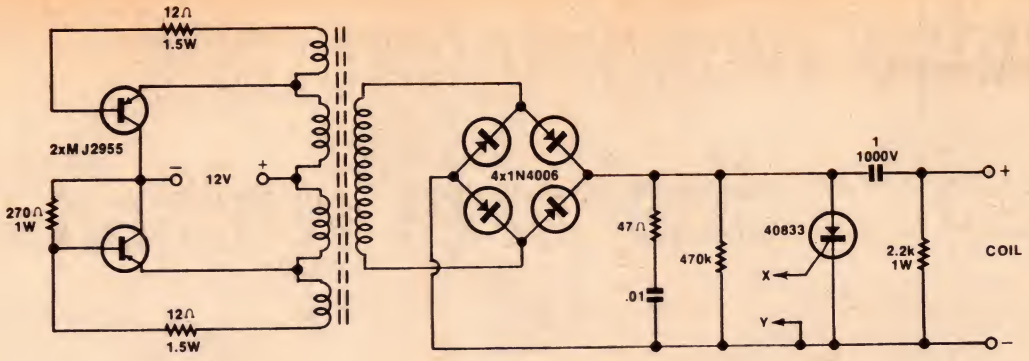


FIG. 3

that all its features are necessary for a road car. At the time a friend of mine was seriously contesting the New Zealand Mini 7 Championship. The Minis are restricted to 850 cc motors and have to pull untold revs to find the necessary horse-power. With a top car, some drivers claim maximum revs can reach a blip of 10,000 rpm off the grid in 1st, 9500 in 2nd and 3rd, and occasionally 9000 in top. Certainly 8500 rpm is commonly sustained.

By virtue of their chamber design, Minis are pretty tolerant in the ignition area and can even be raced with standard coils. So why go to a CDI unit? Two reasons: first, even the good old 2-piece Cooper S points start bouncing at 8000 rpm or so with the ordinary symmetrical distributor cam; second, CD ignition has a unique ability to fire fouled spark plugs, and cold racing plugs have a nasty tendency to oil up if the engine has to be idled for long before a race.

In fact we never noticed any gain in power, but the freedom from fouling was forever appreciated!

So, having decided on CD ignition, the following design requirements were deemed necessary:

- high reliability (for obvious reasons);
- ability to drive an impulse tachometer;
- rapid interchangeability with standard ignition;
- small size and weight; and
- proof against dust and water.

The last couple of requirements really came from use on my own rally Mini. For the rally car, the unit had to be positive earth to suit the alternator, but the design is equally suitable for negative earth vehicles. In fact, both the circuits and wiring diagrams accompanying this article are for negative earth, since this will suit the vast majority of vehicles currently on the road.

Figs. 3 & 4 show the relevent diagrams. The following circuit changes should be made for positive earth vehicles:

- reverse the battery polarity;
- replace the PNP MJ2955 converter transistors with NPN 2N3055s;
- modify the SCR trigger circuit as shown in Fig. 5;
- replace the NPN transistors in Fig. 4 with PNP types. For TR1, TR2 & TR3 use 2N4058, MPS9652T, 2N3702 or BC214; TR4 TIP30A, BC636 (Icmax greater than or equal to 500mA, P_D greater than or equal to 1W); TR5 TIP32A (Icmac greater than or equal to 1.5A, h_{FE} greater than 15 at I_C = 1.5A; and
- reverse the polarity of all silicon and zener diodes and the 400uF electrolytic capacitor across the supply rails.

The third design requirement is a statement of some subtlety. Interchangeability means more than just changing wires. For a competition motor it also means that the carefully tuned ignition timing must not be altered when reverting to the standard system.

The ability of the CDI system to fire fouled plugs derives from its fast rise time — about 15us compared with typically 80us for standard ignition. The 65us difference is not significant at low revs when the sparks are not coming along very often, but at 9000 rpm it has grown to nearly 4° of advance. This is not acceptable and must be eliminated by inserting a 65us delay between the signal from the points and the trigger output to the SCR.

Examination of Fig. 4 will show that the delay is provided by a Schmitt trigger monitoring the voltage on an RC intergrator which also suppresses points bounce. The standard points "condenser" has so small an effect on the time delay that its presence or absence is immaterial. The somewhat complex Schmitt circuit was chosen for its square wave output. In this switching application the Darlington pair used on the Schmitt output is ideal for impedance matching and drives both the SCR gate and the impulse tachometer driver.

The converter is based on the original "Electronic Australia" design featured in August 1970, and has been modified to reduce the output voltage below the original 400V. I have an aversion to the gross tracking caused by voltages over 30kV if a plug lead falls off.

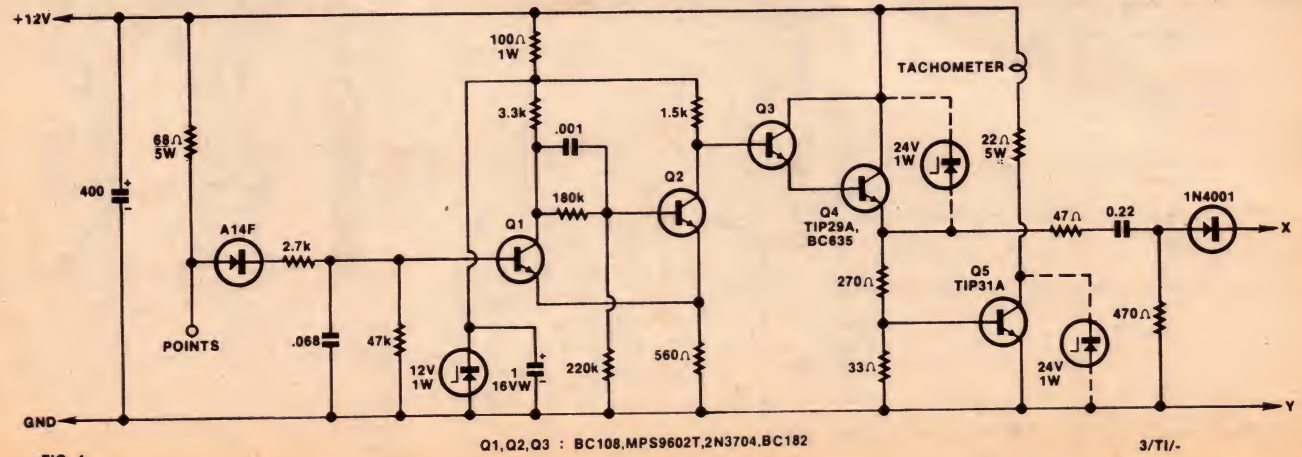


FIG. 4

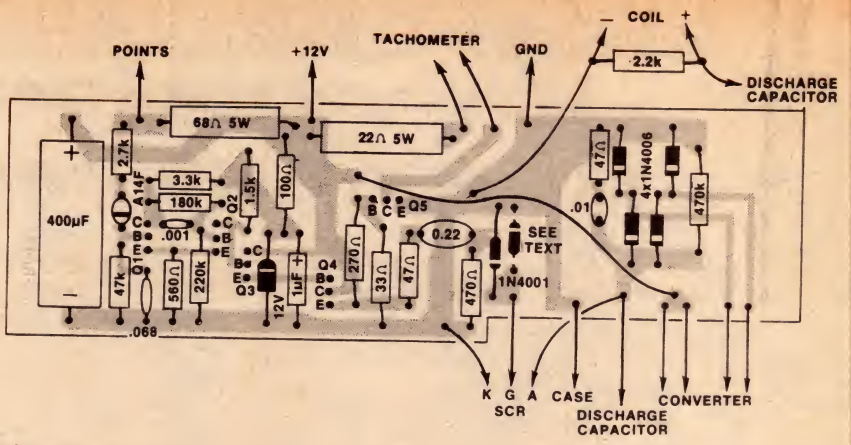


Fig. 6: component layout on the PC board for the negative chassis version. The diode shown with the dotted leads and marked "see text" should be installed for positive chassis versions only. Note also that the lead out to the SCR differs for positive chassis versions (see Fig. 5 below).

Dropping the output to 300 volts still gives a spark energy of 45 millijoules, which is adequate and keeps open circuit EHT voltages within reasonable bounds.

The recommended SCR is the RCA 40833, which has a repetitive peak blocking and reverse voltage rating of 500V. The well-known Plessey Ducon 5S10A should be used as the discharge capacitor to ensure high reliability. A detail of arguable necessity was the use of protective zener diodes across the two power transistors (TR4 and TR5). These are shown dotted on the circuit diagram, and are considered optional.

An immensely strong box was bent up and argon-arc welded from 3 mm aluminium sheet, of exact size to suit the Ducon capacitor and the converter transformer on one level, and the PC board above. The PC board layout is shown in Fig. 6.

For the external connections, seven 6 mm blade connectors were Araldited between Perspex strips, and the car wiring arranged to allow a rapid swap between standard and CD ignition. The lid was made as water-tight as possible and a silicon rubber compound applied to any components that looked like they may try to vibrate.

Connection of a unit into a motor vehicle involves bridging out the series primary ballast resistor (or resistance wire), if this is part of the vehicle's existing ignition circuit. This can easily be done by linking the start and run circuits together at the back of the ignition switch. A seperate lead run from the ignition switch can then be used to power the unit.

Note that the link between the start and run circuits should be broken when reverting to standard ignition. Failure to do this could result in damage to the ignition coil.

How does the unit perform? Very well. It spent most of the summer in the Mini 7 racer with complete reliability and took second place in the Amco Championship. It never missed a beat in my car, in spite of the rough treatment of many hillclimbs, sprints and rallies, and despite being dropped, hit with tools, and soaked in water and mud. I cannot provide photographs as the unit, being positive earth, was sold with the car and remains in New Zealand. Nevertheless, I will build another some day.

My experience with tachometers extends over a number of years while at university when I used to calibrate instruments using the university's excellent signal generators and digital frequency meters.

Without mentioning makes by name, I prefer the impulse type for their very well controlled damping (contrived mechanically with a drop of silicon fluid in the needle pivots) which allows the needle to pretty well keep up with a fast-revving motor without wavering all over the place. However, their linearity is usually not as good as the better Japanese voltage pick-up types.

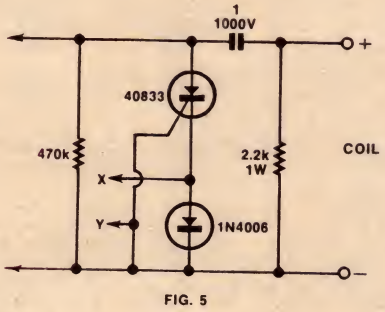
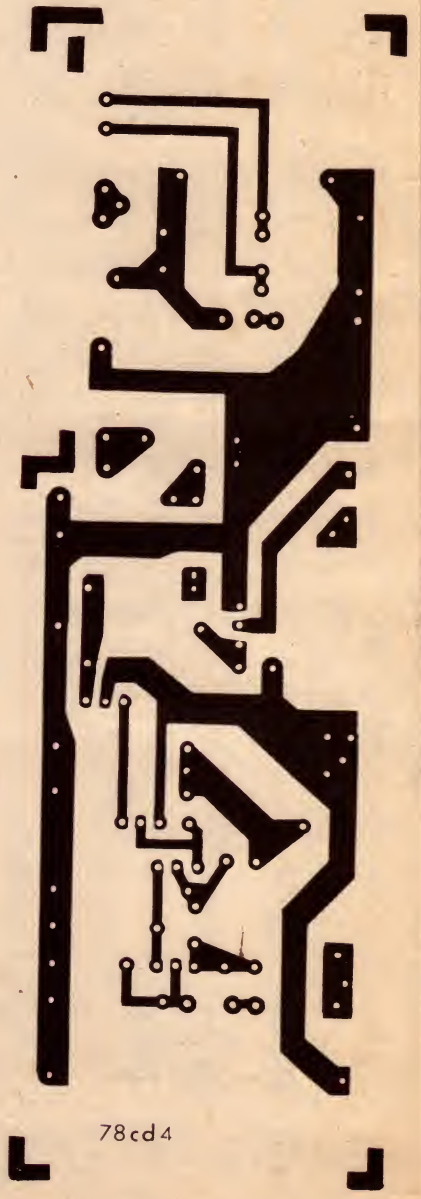


FIG. 5

Some are better than others of course, but the 8000 rpm impulse units will usually be within 150 rpm everywhere if set spot-on at about 6000 rpm. The nasty shocks come when you try one of the 10,000 rpm units commonly used for racing. I have yet to find one of these that does not go crazy over 8500 rpm, despite their considerable scale compression. The best you can do is generally to set them about 300 rpm high below 8000, and accept that they will read about 500 low at a true 10,000 rpm.

Makes you think about all those people who trust their instruments as the word of law!

As a final note, voltage pick-up tachometers can be calibrated by a variation of the set-up described earlier. All you need is a small power transformer; anything giving 9 to 20V from 240V is suitable. Just connect the low voltage winding directly across the low-impedance square wave signal generator or audio amplifier output, and run the tachometer from the 240V winding. Be careful not to short the 240V wires together, or the signal generator output stage may be overloaded.



Here is an actual size reproduction of the PC pattern for those who wish to make their own boards.

CCD's & magnetic bubbles

Two relatively new technologies are currently still emerging in the field of electronic memory devices: charge-coupled devices or "CCDs", and magnetic bubble memories. In this chapter we look at these new technologies, both of which have great potential for very high capacity "bulk memory" applications.

by JAMIESON ROWE

From a purely technical point of view, random-access memory devices of the type we have looked at in the two preceding chapters are the optimum choice where a designer has to provide a digital system with information storage. They offer the speed, elegance and efficiency of a random-access memory, combined with the reliability of a fully electronic device.

All other things being equal, therefore, the designer would prefer to use this type of memory for all of a system's memory requirements. But as it happens, all other things are not equal — costs in particular. In fact the cost of storing a bit of information in a memory device tends to be proportional to the memory's speed of operation and ease of access. Hence fast random-access memories of the type one would like to use tend to be the most expensive, while relatively slow serial-access memories tend to be much lower in cost.

For example fast semiconductor static RAMs currently cost around 1.5 cents per bit of storage, while very high capacity magnetic disc memories offer as low as .005 cents per bit.

Because of this cost structure, systems designers are generally only able to use fast random-access memory devices for part of the overall memory of a system — that part where high speed and fast access are essential. For the remainder of the memory, where speed and access are not quite as important — or less important than sheer capacity — they are forced to use lower cost serial-access devices.

Until very recently, virtually all serial-access memory devices used for such "bulk memory" applications were electromechanical, and based on either a perforated medium like paper tape or cards, or a magnetic recording medium like drums, discs (both rigid and "floppy"), or tapes. While these devices are capable of providing very high storage capacity at relatively low cost, they have a number of acknowledged shortcomings.

Being electromechanical devices with a number of moving parts, they all tend to have significantly lower reliability than purely electronic devices like semiconductor chips. They also tend to be physically bulky, to be relatively slow and to consume a relatively large amount of electrical power. All of these disadvantages have become more and more embarrassing as the electronic elements of digital systems have progressively become smaller, faster, more reliable and lower in power consumption.

Not surprisingly, a lot of effort is being spent on finding more attractive alternatives to these electromechanical devices. And two promising new technologies are currently emerging: charge-coupled device or "CCD" technology, and magnetic bubble technology.

CCD technology was developed in 1970 by Willard S. Boyle and George E. Smith, at Bell Laboratories in Murray Hill, New Jersey. It is based on devices with a metal-oxide-semiconductor structure, and is thus strictly a variant of MOS technology. But compared with the more established forms of MOS device, CCDs are much simpler in structure. This makes them potentially much easier and cheaper to make, as well as being capable of much higher element densities.

Unlike conventional MOS devices, the basic CCD involves no diffused regions in the semiconductor chip. The semiconductor chip itself consists of nothing more than a homogeneous region of doped semiconductor material, either N-type or P-type. Grown on the surface of this chip is the usual silicon dioxide passivation, with a pattern of metal electrodes deposited in turn on its outer surface.

In operation, minority carrier charges are moved through the semiconductor material, at its surface. This is done by manipulating bias voltages applied to the metal electrodes, above the oxide layer. The electrode voltages are used to create "potential wells", consisting of a localised deepening of the depletion layer formed at the semiconductor surface. The wells are then used as vehicles, to collect the minority carrier charges and move them around.

The type of CCD used as a memory device operates essentially as a long shift register. The basic construction and operation of this type of CCD are shown in Fig. 1.

As you can see, the metal electrodes deposited on the oxide layer are arranged in linear fashion. The electrodes are divided into groups of three, and each of the electrodes in each group is connected to a separate bias line. Hence electrodes 1, 4, 7 and so on are connected to one bias line, electrodes 2, 5, 8 and so on to a second line, and 3, 6, 9 and so on to a third line.

In operation, all of the electrodes are biased with a polarity which tends to repel majority carriers from the surface of the semiconductor chip, creating a depletion layer region. In the case of a

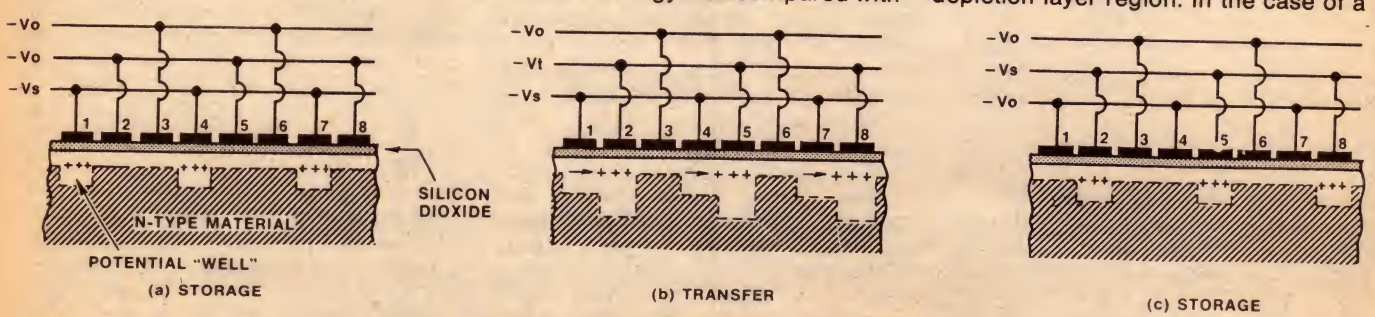


FIG. 1 : BASIC CCD CONSTRUCTION AND OPERATION

CCD using N-type material, as shown in Fig. 1, the bias voltages would all be negative (with respect to the semiconductor chip).

When the device is in the storage mode, shown in Fig. 1 (a), two of the biasing lines are held at a relatively small negative bias level Vo. This produces a uniform depletion layer over most of the chip surface. The third biasing line is taken to a somewhat higher negative voltage Vs, causing the depletion layer to deepen under the electrodes concerned. This forms a series of potential wells, each of which is capable of containing a charge packet of minority carriers (here they would be holes).

Note that in Fig. 1 (a) the wells under electrodes 1 and 7 are shown as containing holes, designated by the small plus signs. In contrast the well under electrode 4 is shown empty. Depending upon the logic convention in use, the "1" and "7" wells could thus be currently storing a binary 1 and the "4" well a binary 0, or vice-versa.

To move the stored information along the device, the bias line voltages are first changed as shown in Fig. 1 (b). Here bias Vs is maintained on the original storage site electrodes, but the bias on the immediately adjacent electrodes on the "forward" side is increased to a negative voltage Vt which is even higher than the voltage Vs used to maintain the storage wells. Typically it is around 10 volts.

The effect of this higher voltage is to create even deeper potential wells alongside the original wells, as shown. As a result the charges transfer into the deeper wells.

The CCD is then returned to the storage mode by reducing the bias on the original site electrodes to the threshold voltage Vo, and that on the new site electrode to the storage bias Vs. This is shown in Fig. 1 (c), and as you can see the situation is similar to that of (a) except that the charge packets have been moved one position along.

By repeating this cycle of events over and over again, the information contained in the charge packets may be moved along the CCD register. Typically this can be made to take place at clock rates of around 5MHz.

The packets of minority carriers may be introduced into the CCD device in a variety of ways. One way is by using a diffused emitter, to introduce them by injection; another way is to generate them within the chip by irradiating it with photons of visible or ultraviolet light.

At the end of the CCD register, the presence or absence of charge packets may be again detected in a variety of ways. One way is to use a diffused collector, while another is to sense them by capacitive coupling to an additional metal electrode on the oxide surface.

Although the performance obtained from planar, three-phase CCDs using a structure like that of Fig. 1 was quite promising, they were found to have a number of problems.

One problem was signal deterioration due to imperfect transfer of the charge packets from one electrode site to the next. Although even the first CCDs had quite a high transfer efficiency — around 98% — this was still too poor to make practical long shift registers.

The main reason for this turned out to be the existence of surface discontinuities in the semiconductor chip. These provided "traps", which tended to collect minority carriers from passing packets and release them into following empty wells. Another reason was the finite time taken for carriers to transfer between wells (this tends to cause transfer efficiency to droop at high clock rates).

The number of surface trap states was reduced significantly by adopting different fabrication techniques, and by increasing the purity of the silicon material. The transfer time problem was similarly improved by reducing the electrode size and spacing, so that the transfer distance was reduced. This enabled transfer efficiency to be increased quite significantly, to around 99.99%.

The other main problem with early CCDs was difficulty in fabrication. To obtain efficient transfer between electrode sites, the electrodes must be

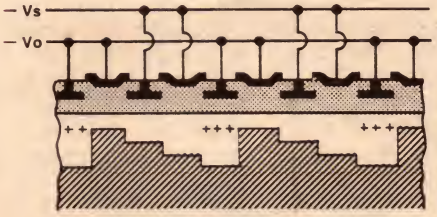


FIG. 2 : TWO-PHASE CCD WITH TWO-LAYER METALLISATION

spaced very close together. The gaps between them must be no more than about 3 um (micrometres), to ensure sufficient coupling between the potential wells. Naturally enough this posed quite a problem in terms of production tolerances, to ensure that the gaps were small enough without producing short circuits.

The most successful solution yet found for this problem has been to adopt a two-layer metallisation scheme, as shown in Fig. 2. Here adjacent electrodes are at different levels, one being on the top of the oxide layer as before, and the other buried in the oxide. They can thus be arranged to overlap slightly, giving very close effective spacing of the potential well sites but without the problems associated with the original planar construction.

Actually when this two-layer metallisation scheme was tried, it was found that it offered another advantage: by interconnecting adjacent "high" and "low" electrodes as shown, the CCD could be made to work with only two-phase clock signals instead of three. This is because applying the same bias voltage to the two electrodes produces two different well depths. The buried electrode, being closer to the semiconductor chip, produces a deeper well.

Hence with only two bias voltages Vo and Vs, applied to alternate pairs of electrodes as shown, "staircases" with a total of four different potential well levels are produced. By simply alternating the voltages on the two bias lines, the staircase patterns are caused to move along the register as before.

Note, however, that the direction of motion is now a function of the device structure. This is in contrast with the planar device shown in Fig. 1, where movement could be produced in either direction at will by manipulating the three clock signals applied to the bias lines.

The CCD structure of Fig. 2 is therefore only suitable for making unidirectional shift registers, but this is not really a disadvantage for most memory applications. In any case it is far outweighted by the advantages: fabrication is easier, only two clock signals are required, and each stage of the CCD register is now only two electrodes long — giving higher packing densities.

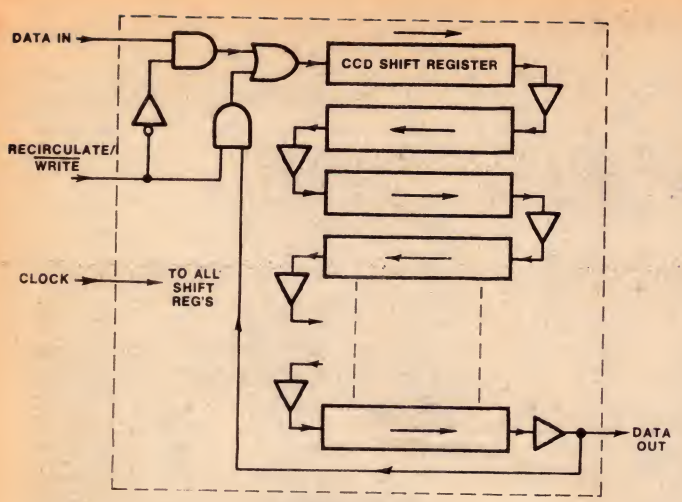
Using this type of structure designers have been able to reduce the size of a single CCD shift register stage to around 200 square micrometres, allowing memories with a capacity of 65,536 bits to be built on chips around 5mm square. Contrast this with the 4096 bits of storage currently being achieved on the same sized chip with static MOS RAMs and you can begin to see the potential of CCD technology.

It is predicted that by 1980 it will be possible to have CCD memories with a capacity of 128,000 bits on a 5mm square chip. By 1985 even this figure is likely to have quadrupled!

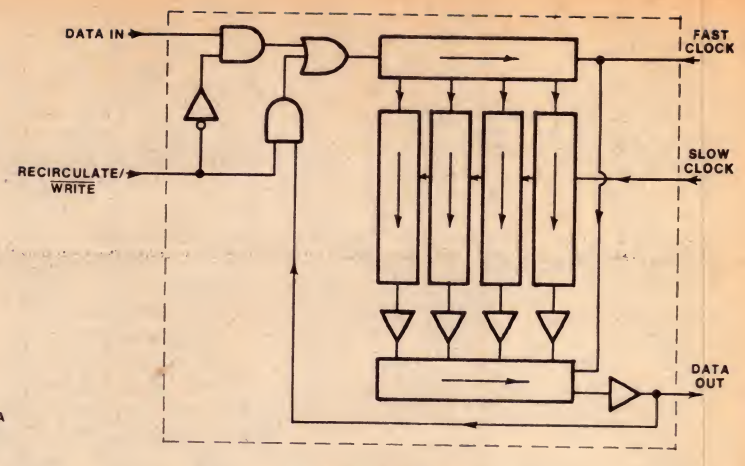
At the moment there are three broad ways in which memory CCDs are organised, and these are shown in Fig. 3. The serpentine loop scheme in (a) is the simplest, and was used on the earliest devices. As you can see it involves connection of all internal shift registers into a continuous serial register, broken only by small amplifiers used to regenerate the charge packets. The name "serpentine" comes from the way the registers are arranged on the CCD chip, so that the signal path snakes back and forth.

Logic gates are used as shown so that data may be fed serially into the memory, and then continuously recirculated around the loop. While recirculating, it may also be read out nondestructively via the data output.

The serpentine organisation gives quite good results, but because it con-



(a) SERPENTINE CCD



(b) SERIAL-PARALLEL-SERIAL CCD

FIG. 3 : CCD ORGANISATION

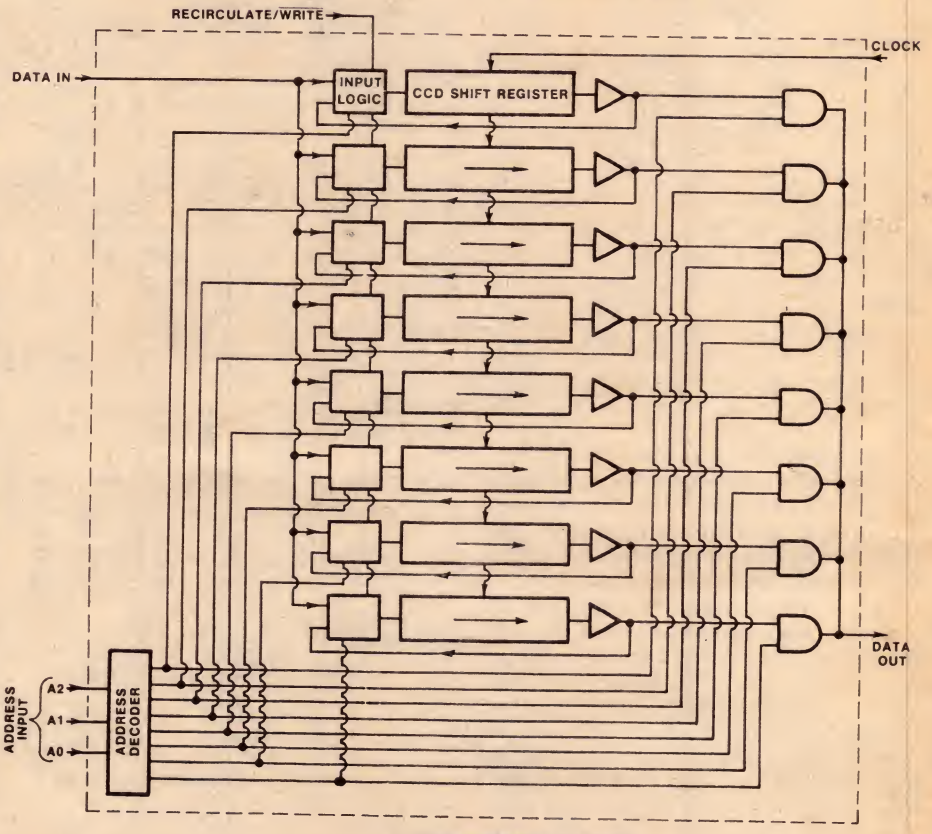
sists basically of a single long serial register, access time tends to be fairly long for a given clock rate. Also the need for a lot of regeneration amplifiers tends to increase power dissipation.

In an effort to overcome these disadvantages the serial-parallel-serial organisation shown in (b) was developed. As the name suggests this uses a three-stage scheme. The data is read into the memory serially, at a fairly high clock rate, into an input register. It is then shifted out in parallel into an array of parallel registers, which form the main memory section of the chip. The parallel registers work at relatively low speed, and this together with the fact that they are relatively short means that only one set of regeneration amplifiers is required. At the end of the parallel registers the data is then loaded into an output register, where it may be shifted out again at a high clock rate.

The power consumption of the serial-parallel-serial CCD memory is significantly lower than that of the serpentine organisation. This is partly due to the fact that most of the memory works at relatively low speed, and partly because of the smaller number of regeneration amplifiers. The reduced number of regeneration amplifiers also means that there is more room available on the chip for actual memory storage. And because the data is stored mainly in parallel form, access time can be lower than with the serpentine approach.

The third type of CCD organisation is shown in Fig. 3(c), and is known as the line-addressed CCD "RAM". As you can see it involves a number of separate CCD shift registers. These are clocked simultaneously, but not accessed in parallel. Instead they are accessed individually and separately via logic driven by an address decoder. Any one of the registers may be written into or read from, by applying the corresponding address code to the decoder address inputs.

Normally the registers are all recirculating individually. To write into a register, its address code is applied to the decoder inputs, and the recirculate/write logic input taken to its write enable level (here logic low). Serial data applied to the memory input is then shifted into the selected register. When the data ends, the recirculate/write logic input is taken back to its original logic level to restore the register to the recirculate mode.



(c) LINE-ADDRESSED CCD "RAM"

To read a particular register, all that is necessary is to apply its address code to the decoder inputs. The data in the register will then be available at the data output of the device, as it recirculates. Again this read operation is non-destructive, as the recirculated data is not affected.

Although it is obviously not a true random-access memory, the line-addressed CCD does offer some of the advantages of a RAM. Because the data is stored in a number of individually addressable registers, it is more readily accessible than with either the serpentine or serial-parallel-serial schemes. And because the individual lines are relatively short, few regeneration amplifiers are needed, keeping power dissipation down.

In short, the line-addressed CCD "RAM" is the one that offers the highest performance, and the one which seems to have the greatest potential in terms of future development as a low-cost, high reliability replacement for electromechanical bulk memory devices.

At the time of writing, Fairchild Semiconductor has just released a line-addressed CCD memory device with a capacity of 65,536 bits. It is organised as 16 registers, each of 4096

bits, and may be clocked at rates between 1MHz and 5MHz. At 5MHz clock rate, the average access time or "latency" is 410us (microseconds), which compares very well with electromechanical bulk memories.

However there is one aspect of performance in which CCDs do not compare favourably with electromechanical bulk memory. They are volatile — i.e., the stored information is lost if power is removed from the memory chip. This is in contrast with virtually all electromagnetic memories, where the information remains stored in either mechanical or magnetic form.

Of course this disadvantage may be overcome by using a battery-backup power supply, so that power is never removed from the CCD memory chips. However this can be expensive where large memories are concerned. Needless to say, designers would prefer having solid state bulk memory devices which were themselves non-volatile, to obviate this problem.

Happily this disadvantage does not apply with the second emerging memory technology — magnetic bubbles. As the name suggests these store information in magnetic form, and can be arranged to provide non-volatile storage quite easily.

Like CCD technology, magnetic bubbles were developed at Bell Laboratories. The technology was first announced in late 1967, but development has been rather slow since then, and it is only now in 1977 that the first commercially available magnetic bubble memories have emerged.

Unlike CCDs, magnetic bubble memories are not semiconductor devices at all. Many of the steps used to manufacture them are similar to those used to manufacture CCDs and other integrated circuits, and like ICs they are relatively small devices with no physically moving parts. But there the similarity ends. In fact a bubble memory is closer in operation to a magnetic disc or drum, in that it stores information in the form of a magnetic recording.

The only difference is that in a magnetic disc or drum, the magnetic medium must be rotated in order to store the recording over its surface. In the bubble memory, the medium stays fixed, while the actual "recording" is made to move around!

The operation of a bubble memory depends upon the magnetic properties of a class of materials known as orthoferrites. In particular the material most used to date has been a magnetic garnet, in single crystal form. In this form, the properties of this type of material are such that it may be magnetised much more readily in one crystalline axis than in the others.

If a very thin slice of the material is produced, with this axis of preferred magnetisation perpendicular to the plane of the slice, it thus tends to be

magnetised in either the "upward" or "downward" directions. In fact even when the slice as a whole has no net magnetisation, there tend to be localised regions or "domains" within it which are magnetised one way or the other. All that happens when there is no nett magnetisation is that the domains magnetised in one direction are balanced out by those magnetised in the other.

An interesting thing happens in such a slice if an external magnetic field is applied, again perpendicular to the wafer. The domains which are oriented in the opposite direction to the field tend to contract, while those orientated in the same direction as the field expand. By increasing the field intensity up to a certain point, the oppositely magnetised domains can be made to shrink into tiny "bubbles", as small as 2 micrometres in diameter. The other domains expand out and merge to occupy all of the remainder of the slice.

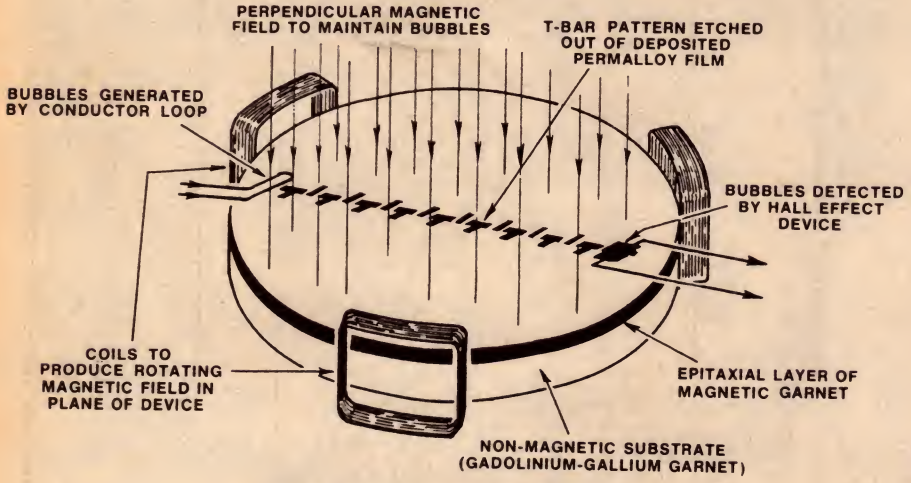


FIG. 4 : BASIC MAGNETIC BUBBLE DEVICE

Actually it is possible to create new bubble domains in the slice, by passing current through a small loop of conductor close to the surface, to produce a small localised field opposing the main field. It also proves to be possible to manipulate the bubbles present in a slice, so that they can be used to store information. And the bubbles will continue to exist in the slice as long as required, provided that the main "bias" field is maintained.

Fig. 4 shows the basic structure of a practical bubble memory device. The heart of the structure is a very thin layer of magnetic garnet, grown epitaxially on the surface of a thicker slice of non-magnetic rare earth (gadolinium-gallium) garnet which serves as a substrate. A permanent magnet is used to apply the perpendicular bias field required to maintain the bubbles.

Bubbles are produced at one end of the device by a small conductor loop near the surface. This acts as the input of the device. Once created, the bubbles are manipulated and moved around, by means of a further magnetic field which rotates in the plane of the slice. The rotating field is produced by a set of coils, as shown, and acts on the bubbles via a pattern of thin and magnetically "soft" permalloy pole-pieces on the surface of the chip. The pole-pieces are extremely tiny, being produced by depositing a layer of permalloy on the chip and then photo-etching it using IC fabrication techniques.

Typically the pole-pieces are shaped either like arrowheads, or as alternate "bars" and "tees" as shown. The latter arrangement is known as the "T-bar" system. Either way, the pole-pieces are arranged as a long continuous chain, which may be laid out in serpentine fashion.

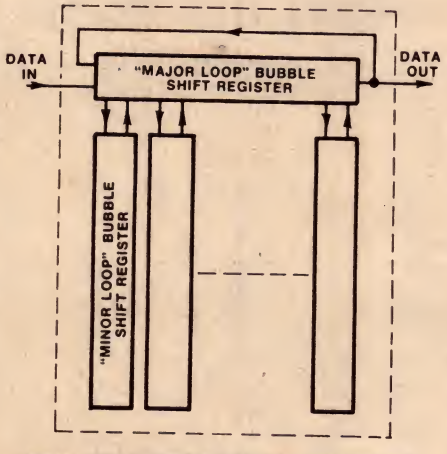


FIG. 5 : TYPICAL BUBBLE MEMORY ORGANISATION

What happens is that the tiny pole-pieces become dynamic induced magnets, under the influence of the rotating magnetic field produced by the coils. And the shape of the pole-pieces together with their spacing causes any bubbles present to be drawn along the chain. Each full rotation of the field causes a bubble to move one stage along the pattern — i.e., one T-and-bar in the case of a T-bar device.

The pattern produced by the pole-pieces thus becomes a shift register, capable of storing information carried by the bubbles. The register clocking rate corresponds to the rotational frequency of the field produced by the coils. Currently this is around 1.25MHz.

At the end of the register, the presence or absence of bubbles is detected by a suitable magnetic sensor. Typically this is a small Hall-effect element, as shown in Fig. 4. The readout may be either destructive or non-destructive, as desired, so that recirculating registers are quite feasible.

Many of the early bubble memories used a single long register of this type, arranged in serpentine fashion rather like the CCD register organisation of Fig. 3(a). Devices of this type are practical, and have been used for no-moving-parts data recorders and similar applications. However until the fabrication techniques used to make bubble devices have been fully refined, this type of construction tends to have yield problems. Any slight fault anywhere in the register can render it unusable.

More recent bubble memories have tended to use the organisation shown in Fig. 5, known as the "major-minor loop" system. Here the so-called "major" loop register is used to feed serial information into and out of the device, while the actual storage is performed by a number of "minor" loops. Each of the minor loops is of the recirculating type.

A typical device of this type has some 157 minor loops, each consisting of 641 stages. This provides a potential storage capacity of 100,637 bits, with an average access time of around four milliseconds. Actually the idea of having 157 minor loops is that there is some redundancy, to allow for faulty loops. The device is nominally regarded as having 144 loops, giving a nominal capacity of 92,304 bits. The additional 13 minor loops are to ensure that this capacity will be available.

This device is housed in a modified 14-pin dual in-line package which measures 25 x 27 x 10mm. Included in the package are the bubble chip, a pair of permanent magnets for the bias field, the coils for the rotating field, and a magnetic shield to protect the device from external fields.

Eight such memory devices, together with the necessary interfacing logic, can be mounted on a single printed circuit board to form a 92,304-byte bulk memory weighing less than 320 grams.

The future for bubble technology seems bright. Already devices with a capacity of 250,000 bits on a single chip have been produced in research laboratories. By 1980 it is predicted that bubble sizes will be down to below 1um, allowing memory densities of around 150,000 bits per square millimetre. It should then be possible to produce single chips with capacities of around 10 million bits, at a cost which should make them very attractive as replacements for floppy discs and similar devices.

COMPUTER BACKGAMMON

Futuretronics have done it again. The worlds first microprocessor based backgammon game is here right now. Its you against the computer. A sophisticated, totally computerized backgammon game, utilizing a Motorola-6800 microprocessor with 2-K ROM and 6K RAM, designed for excitement and ease of play. It will defeat the average player more often than not, and compete evenly with experts. When you play against the computer, each move is displayed and recorded electronically. The position of every piece on the board can be verified at any time and since the dice are "rolled" electronically at random, each game is different. The computer plays an aggressive offensive game, but will change its strategy depending on how you choose to play. Running game, block and hit, back game, it knows them all, and plays them all well. Playing against the computer is a true measurement of skill. If you are a beginner it is a remarkable learning instrument. This beautifully finished, top quality product complete with its own carrying case is available now for $299.00 delivered free anywhere in Australia.

COMPUTER CHESS

It's you against the computer.
The first microprocessor based chess game, using an 8080A C.P.U. It utilizes an 8224 clock generator/driver, 8228 system controller, 512 8-bit bytes of random access memory, that stores the position of the chess pieces, and a 16,384-bit read only memory. Software contains such elements as the rules of chess, the relative importance of the pieces, allowable moves and strategies. The micro computer plays by the book, working on the weighted value of the pieces, and completely scanning the board for the best available move each time. It plays aggressively, tries to control the centre of the board, and, if it's in trouble, will try for a stalemate.
The keyboard can be used to verify the position of each chess piece at any time during the game.
User selectable 3 levels of difficulty choice of black or white pieces. New shipment just arrived, new low price $345.00 delivered free anywhere in Australia.

To order or for information contact:

Futuretronics pty. ltd.

☐ PLEASE SEND GAMMONMASTER. I ENCLOSE $299.00
☐ PLEASE SEND CHESS CHALLENGER. I ENCLOSE $345.00

Name .....
Address .....
State ..... P/Code .....

☐ **PLEASE SEND BOTH GAMES. I ENCLOSE $599.00**

1 DALLAS CRT, HUGHESDALE, 3166, VIC. PHONES: (03) 82-3732 — (03) 579-5297

Microcomputer News & Products

N-channel PACE

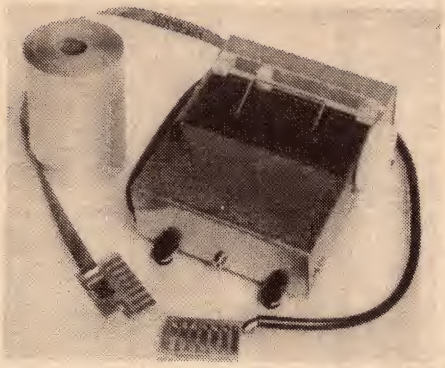
National Semiconductor has announced a new N-channel version of its established PACE 16-bit microprocessor. Designated the INS8900, the new processor offers higher speed and lower cost than the P-channel device, together with direct Schottky-TTL compatibility on all inputs and outputs. The INS8900 also requires only single-phase clock signals.

The new device is completely software compatible with the P-channel PACE chip, offering the identical 45-instruction repertoire. The higher operating speed of the INS8900 combined with the higher efficiency of single-word 16-bit instructions makes it very fast, significantly faster than most 8-bit processors.

Further information on the INS8900 is available from NS Electronics Pty Ltd, cnr Stud Rd and Mountain Hwy, Bayswater, Victoria.

Printer mechanism . . .

A new low cost alphanumeric printer mechanism from Matsushita Electric is being marketed by Philips Electronic Components and Materials. Known as the EUY-10E series printer, the unit is compact and very quiet in operation. It employs non-impact printing, using standard metalised paper in 60mm-wide rolls.



The printing head uses a 7 x 5 dot matrix and operates at a rate of approximately 2 lines per second. Character height is a nominal 2.4mm, and models are available giving 15, 21, 32, or 40 characters per line. Four options are also available in terms of printing mode, with head movement from L to R or R to L, and platen up or platen down.

Overall dimensions of the printer mechanism are 90.5 x 42.5 x 110mm (W xH x D), with a mass of 370 grams. Useful life of the printer is rated as 3 million lines. The motor runs from 24V DC, and draws an average current of 85mA. Each of the 7 print head inputs requires 24V drive, with 3.5A peak dot current.

In 1-off quantities, the Matsushita EUY-10E printers are available from Philips for $60 plus tax, with the metallised paper also available at $3.85 per roll. However there is a surcharge of $4 for orders of less than $25, from Philips themselves.

Further information is available from Philips Electronic Components and Materials, 67 Mars Road, Lane Cove NSW 2066. The printers are also available from Philips distributors in each state.

. . . or with electronics

For those who do not want to design their own electronics for the Matsushita Electric printer mechanism described above, Daneva Control offer their Duoprint printer assembly. This adds to the basic printer mechanism all necessary character generation and interfacing circuitry, so that the printer may be fed from a micro-processor system or other source of data asynchronously in either serial or parallel mode.

The Duoprint offers a standard 6-bit ASCII character set of 64 characters. It features a line character buffer, so that incoming characters may be stored in the buffer until enough have been assembled to print a line. Lines of either 20 or 40 characters may be produced, with logic selection between the two formats. Overall dimensions of the Duoprint are 110 x 112 x 57mm, with a mass of 500 grams.

Cost of the Duoprint in 1-off quantities is $275 plus tax. Further information is available from Daneva Control Pty Ltd, 70 Bay Road, Sandringham, Victoria 3191.

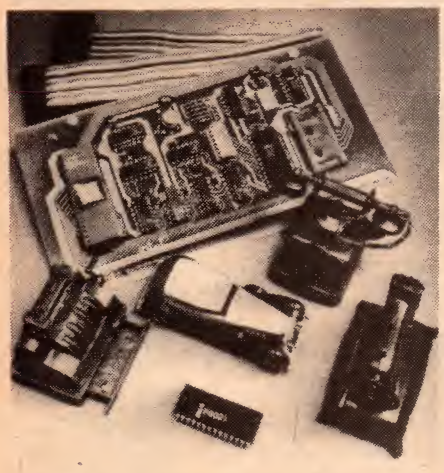
SWTPC disc kit

Southwest Technical Products Corporation has released a dual minifloppy disc drive kit, for use with their SWTP 6800 computer system. The MF-68 employs two Shugart SA-400 minifloppy disc drive units, which come fully assembled. It also provides a sturdy case, a power supply and a controller unit based on the Western Digital FD-1771 LSI chip.

The kit comes with the usual detailed assembly manual, a diskette with DOS software, and an operating manual.

Further information and prices are available from Southwest Technical Products Corporation (Australasia), P.O. Box 380, Darlinghurst, NSW 2010.

Intel 1-chip controller



Intel Corporation has announced a new low cost single-chip microcomputer, the 8021, designed specifically for high volume dedicated control applications. Inside the 8021 is an 8-bit central processor, 64 bytes of RAM, 1024 bytes of program ROM, 21 input/output lines, a system clock and a programmable timer event counter. The price is an incredible $3, when bought in large OEM quantities!

Special offer for EA readers:

Low cost record of useful 2650 software

Here is some good news for those using small microcomputer systems based on the Signetics 2650 microprocessor. Electronics Australia and Philips Electronic Components and Materials, in conjunction with the 2650 Users' Group, have produced a low cost 175mm 33 1/3rpm record of useful 2650 system software. You can load the software into your system via any standard cassette interface.

by JAMIESON ROWE

Most small microcomputer systems based on the Signetics 2650 microprocessor use the monitor/debug program 'PIPBUG", resident in a ROM (read-only memory), to control program entry, manipulation and execution. And compared with many similar monitor/debug programs supplied with small microcomputer systems, PIPBUG is very good. It allows you to dump programs onto paper tape or cassette and reload them into memory, and to run them in controlled fashion with up to two breakpoints.

However like most small monitor/debug programs, PIPBUG has its limitations. After you have used it for a while, these become fairly apparent. You soon find yourself hankering for a faster and more convenient way of feeding long programs in, examining them when they have been fed in, moving parts of them around in memory, checking the accuracy of dumps, dumping and reloading, and so on.

As it happens, many of the utility programs required to do these things have already been produced, by people who have been working with small 2650 systems for a while. So there's no need for newcomers to "reinvent the wheel".

To help those who are just starting to get under way with their 2650 system, we have gathered together a group of these utility programs which we think are likely to be of most interest and value. With the generous support of Philips Electronic Components and Materials, and the co-operation of the 2650 Users' Group, we have recorded the resulting "software package" on a low cost 175mm 33-1/3rpm disc. This can be played on any standard record player, and fed into your 2650 system via a standard cassette interface such as the one we described in the April 1977 issue (File number 2/CC/19).

The programs in the package include routines for feeding in programs faster, listing them more efficiently, moving them around in memory, searching them for certain instructions, verifying dumps, measuring the length of programs in dumped form, disassembling them for analysis, dumping them and reloading at higher speed than with PIPBUG, and producing dumps which automatically begin execution when they are loaded. There are also two short game programs, for amusement and system demonstrations.

All of the programs recorded on the disc have been dumped from a 2650 system using PIPBUG, so that they are in the Signetics "Absolute Object Format", and hence suitable for loading into other systems under PIPBUG control. The system from which they were dumped has a total of 4k (4096) bytes of RAM in addition to the 1k PIPBUG ROM, with the RAM occupying the hexadecimal address range 0400-13FF. Some of the programs currently occupy memory locations near the top of that range.

As many small 2650 systems are likely to have at least this much RAM, most of the programs should be usable as they are. However if your system has a smaller memory, you should still be able to use many of the programs. Quite a few of them are either relocatable without any changes at all, or require only a few minor changes. Others are already located down at the bottom of RAM memory space, and should be directly usable.

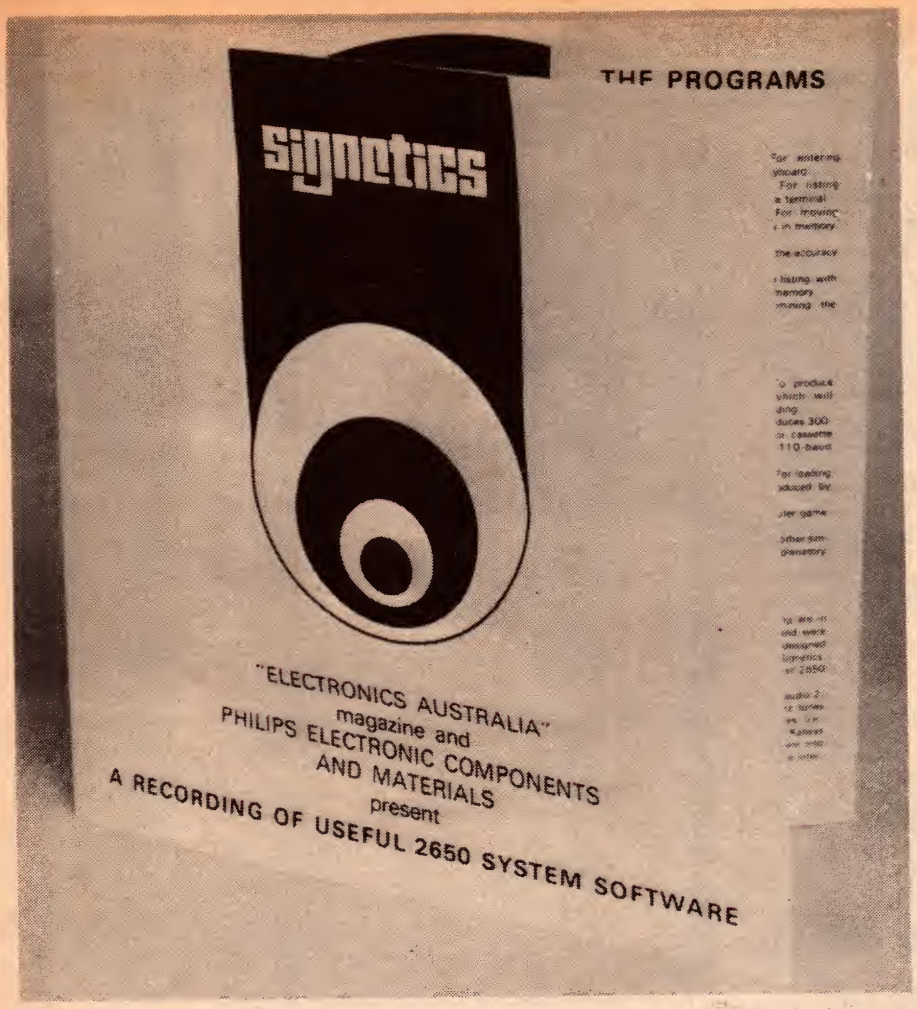
The programs have been recorded on the disc using the 2-tone "audio FSK" technique, with binary 1 and "mark" represented by a tone of 2400Hz, and binary 0 and "space" represented by 1200Hz. These are the same tones used in standard microcomputer cassette interfaces, based on the so-called "Kansas City Standard" originated by the American magazine Byte. Hence you should be able to feed the programs from the disc into your system simply by connecting a standard record player up to your system's cassette interface, in place of the cassette tape recorder.

If you experience any trouble loading them into your system in this way, it will probably be because your cassette interface is not set for exactly the standard frequencies. A judicious adjustment of the interface may therefore be required, by trial and error, until loading takes place correctly. This will be a simple procedure if you are using the cassette interface described in the April 1977 issue, as you will only need to adjust the 4.7k "clock adjust" preset pot a little one way or the other.

As a special offer to EA readers, we are making the 2650. Software Package Recording available at the nominal price of $2.50, or $3.00 posted anywhere within Australia. However your remittance should be accompanied by the order coupon given in this article, unless you live in a State where this requirement is illegal — in which case a letter giving the same information may be sent instead.

But note that this offer is strictly limited. Only 1000 discs have been produced, and when these have gone the offer must close. So be early if you don't want to miss out!

As you can see from the photograph, the 2650 Software Package Recording comes inside a matching protective sleeve. On the sleeve is printed brief information on each of the various programs on the disc, and their use. However in order to let you evaluate their potential value to you in advance, the remainder of this article gives a somewhat expanded description. Also given are program sizes and relocatability.



Supplied in an informative sleeve, the record plays on a standard player. It provides nine handy items of 2650 software, plus two games.

1. HEX INPUT ROUTINE

This simple program allows either programs or data to be fed into your system in hexadecimal code from a terminal keyboard, more speedily and more conveniently than with the PIPBUG input routine. The data or instruction bytes are fed in as lines of any length, each line beginning with the address in which its first data byte is to be stored. The address and each data byte must be terminated by any convenient non-hex character, such as a space or comma.

Thus by typing:

440s3Fs82s69sCDs84s7Fr

where "s" is a space, and "r" is a carriage return, the input routine will load 3F into location 440, 82 into 441, 69 into 442 and so on. Note that the last data byte on the line may be terminated by the carriage return character; a space is not necessary. The program automatically provides a line feed, also.

When typing in both the address and the data bytes, no leading zeroes are necessary. Thus an address typed as "440" is automatically interpreted as 0440, while a data byte with a value of 02 may be entered simply by typing "2s". Zero bytes may be entered by simply typing a terminator character, such as a space.

As the program automatically enters only the last four digits before the terminator, in the case of an address, or the last two digits in the case of a data byte, errors discovered before typing the terminator may easily be corrected. Simply continue typing, to make the last four or two digits correct. Thus typing:

44F0440s6BCbs

will enter C8 into location 0440. But note that when correcting errors in this way, you must type in any leading zeroes as well.

Any number of lines may be entered, as long as each line begins with its appropriate initial address. The addresses of each line need not follow those of the line before, nor preceed those of the next line; all lines are treated independently. This allows convenient correction of lines,and entering of multiple programs.

To escape from the program and return to PIPBUG, either type a Control-G (BELL character) or press the system reset button. It may be necessary to type control-G twice.

As recorded on the disc, the hex entry routine occupies memory locations 1250 — 162D. However it is relocatable and may be moved anywhere in page 0, that is anywhere from 0440 to 1FFF (PIPBUG itself occupies 0000 — 03FF). It also contains no scratchpad locations, making it suitable for storage in a ROM if desired. It uses PIPBUG subroutines STRT, CHIN and COUT. Call by typing G1250r. This program was written by the author.

2. HEX LISTING ROUTINE

This program enables you to list a program or data stored in your system's memory on a terminal, in hexadecimal code, more conveniently than with PIPBUG. The listing is done in lines, with each line beginning with a 4-digit address and followed by up to either 16 or 8 two-digit groups representing the data bytes, separated by spaces. The memory range to be listed is given to the program as part of its calling protocol; when called the program lists the memory contents in the specified range, then returns control automatically to PIPBUG. It must therefore be called separately for each listing.

As recorded on the disc, the listing program occupies memory locations 1200 — 1248 inclusive. However it is relocatable, and may be moved anywhere in page 0. It may also be stored in a ROM if desired. Call by typing G1200sAAAAsBBBBr, where AAAA is the start and BBBB is the finish addresses of the range to be listed.

At present the program is arranged to list in lines of up to 16 data byte groups, so that lines will have up to 53 characters. If the terminal or printer you are using can only handle lines of 32 characters or less, you can alter the program to list in 8-byte groups by changing the instruction byte in location 1244 from "0F" to "07".

The hex listing routine uses PIPBUG subroutines GNUM, STRT, CRLF, BOUT and COUT. It was written by the author.

3. BLOCK MOVE & SEARCH

The block move routine allows you to move the contents of the locations in any designated memory range either up or down in memory. It may thus be used to move complete programs or data, or to move part of a program for insertion or deletion of instructions. The destination and source ranges may overlap, so that moves of as little as one byte are permitted in either direction. Note, however that the program uses indexing and will not move data correctly where either the source or destination ranges flow over 2650 page boundaries. However the source and destination range may lie in separate pages.

As supplied the block move routine occupies memory locations 1100 — 1183. However it is relocatable and may be moved anywhere in page 0. It uses PIPBUG subroutines STRT and GNUM.

ECONOMY POWER SUPPLY

Ideal for microprocessors, this kit supplies +5v/10A, +12v/1A, −12v/1A fully regulated (S100 users can use the +8v. ±16v unregulated outputs as well) and optional overvoltage protection can be fitted. This comprises of transformer, bridge rectifier and all diodes, filter capacitors, PCB. regulators and full assembly instructions. Can be readily adapted to fit any metal work.

$49.50 KIT EPS.100
Package and Post $3.50

CASSETTE INTERFACE

Adapted from a design described in Radio Electronics, this 300 baud interface uses the Kansas City standard 1200/2400 Hz. encoding. Easily constructed, using standard TTL chips and a special test tape is supplied to simplify alignment. Kit is supplied with PCB, all components, test tape and full instructions.

$22.50 KIT R.E.C.I.
Pack and Postage $1.00

S100 PROTOTYPE BOARD

This is an ideal card for any prototype work. Consists of top quality tin plated PCB with hard gold S100 edge fingers. Will suit virtually any IC package, has power and ground plane and provision for on card voltage regulator.

$19.50 S100 PROTO BOARD
Pack and Postage $1.00

S100 MOTHER BOARD

This 8 slot S100 Mother Board will greatly simplify construction of your S100 system. Has provision for power distribution and bypass capacitors. Also accepts 16 PIN DIL connections to adapt to other systems.

$22.50 S100 MOTHER BOARD
Pack and Postage $1.00

LOW COST V.D.U.

As described in E.A. February, this compact V.D.U. is an ideal peripheral for microprocessor systems.

- 32 characters/line. 16 lines.
- parallel ASCII (TTL) input.
- video output.
- 1K on board memory.
- Automatic scrolling, carriage return, line feed.
- screen clear facility.
- uses low power TTL and MOS devices.
- requires +5v at 800 M.A.
  −12v at 30 M.A.
- Plated through hole PCB.
- supplied with full instructions and trouble shooting guide and Xtal.

$99.50 LOW COST V.D.U.
Pack and Postage $2.50

TRISTATE LOGIC PROBE

This very simple device works with TTL circuits and TTL compatible levels from microprocessors and identifies LOW LOGIC STATE . . . . . .
HIGH LOGIC STATE.
FLOATING OR H1 Z INPUT.
EXCESSIVE OR INSUFFICIENT VCC.

Also doubles as a pulse injector!

Kit consists of PCB, IC's, LEDS, RESISTORS/CAPACITORS and full instructions.

$2.50 POST FREE

OR

FREE with any order over $20.00 (offer expires April 15, 1978).

SC/MP ON S100 CARD

Interested in expanding your Miniscamp to a more useful system? This handy PCB. makes it possible to connect the SC/MP (N or P Channel) to the hobby standard S100 buss. Has provision for Xtal clock and full buffering of the chip, and of course on-card regulators. Board is top quality fibre glass tin plated with hard gold S100 edge fingers.

$19.50 S100/SCMP BOARD
Pack and Postage $1.00

APPLIED TECHNOLOGY PTY. LTD.

POSTAL ADDRESS P.O. Box 355, Hornsby, 2077

bankcard welcome here

SHOWROOM 109-111 Hunter St., Hornsby 2077
(9-5 Monday to Sat)

PHONE 476 4758 – 476 3759

It is called by typing G1100sAAAAsBBBBsCCCCr, where AAAA and BBBB are the start and finish respectively of the present memory range occupied by the block to be moved (i.e., the source range), and CCCC is the start of the memory range to which it is to be moved (i.e., the destination range).

After moving the data, the block move routine automatically returns control to PIPBUG. The routine was written by Ian Binnie.

The accompanying block search routine is designed to search through a designated memory range for a specified pattern in two adjacent locations. Wherever the pattern is found, the routine prints out the address of the second byte of the pattern. It may therefore be used to find specific instructions in a program, or data in a table. It can search any desired memory range, even a range which flows over a 2650 page boundary.

The block search routine is designed to be used in conjunction with the block move routine, and this is why the two are combined on the record. However the two are quite independent, and may be separated if desired. As supplied the block search routine occupies 1190 — 11D7, but it is relocatable and may be moved anywhere in page 0.

To call the block search routine, type G1190sAAAAsBBBBsXXXX, where AAAA and BBBB are the start and finish respectively of the memory range to be searched, and XXXX is the two-byte pattern to be found. The routine will print out the locations at which it is found, and then return control to PIPBUG. The block search routine uses PIPBUG subroutines STRT, GNUM, CRLF and BOUT. It was written by Craig Barratt.

4. TAPE VERIFIER

After you have dumped a program from your system's memory onto paper tape or cassette using PIPBUG, this verifier program lets you check that the tape or cassette has a faithful copy. It does this by reading the tape or cassette, and comparing it with the original still residing in the system memory. If there are any errors, the verifier program will type out an appropriate message. Otherwise it will type out "TAPE OK".

The verifier checks for both address and data BCC (block control character) errors on the tape or cassette, as well as for data byte errors. Currently the verifier occupies memory locations 1360 — 13F3 inclusive. However it may be moved to any desired part of page 0 by modifying the contents of the instruction bytes currently in addresses 13B6 and 13B7. The five least significant bits of the byte in the first location and the full byte in the second must correspond to the address of the byte SIX BYTES after the second of the two bytes, for correct printout of the verifier messages.

Thus currently these bytes are 37 and BD, corresponding to address 13BD. If the verifier were moved to occupy 760-7F3, you would thus need to change the contents of 7B6 and 7B7 to 27 and BD respectively. If it were moved to occupy 500-593, the contents of 556 and 557 would need to be changed to 25 and 5D respectively. Note that the sixth least significant bit of the first of the two bytes is always set; this is for correct indexing.

To use the verifier, simply call it by typing G1360r. Then feed in the tape or cassette, as if you were loading it. Note, however, that for correct operation the original program on the tape or cassette must still be resident in the system memory. The verifier will either type out a message as soon as it finds an error, or will give the "TAPE OK" signal at the end of the tape. After giving a message the verifier returns control back to PIPBUG.

The verifier uses PIPBUG subroutines CRLF, CHIN, BIN and COUT. It was written by the author.

5. DISASSEMBLER

This program may be used to examine a program or part of a program in your system's memory, and produce both a hexadecimal listing and a reconstruction of the program in mnemonic or assembly language. This allows convenient analysis of programs, and is also of value in tracking down subtle logic errors, errors in program entry and errors in calculating relative addresses and PC-relative branches.

Not all of the codes in the 2650 instruction set are translated into mnemonic form by the disassembler; some infrequently used codes are ignored. However all commonly used codes are translated, and absolute addresses are calculated for relative addressing instructions. This allows very convenient program analysis. However please note that the program does not calculate the absolute address correctly for relative indirect addressing instructions which are "forward referencing" — i.e., those which reference higher addresses.It does calculate the correct address for those which are backward referencing.

The disassembler listing is 31 characters wide, making it suitable for use with almost every kind of terminal and printer. It occupies the memory range 0F00 — 1082, and is not easily moved.

To use the disassembler, call it by typing GF00sAAAAsBBBBr, where AAAA and BBBB are the start and finish of the range in memory occupied by the program or section of program to be disassembled. For long programs, the disassembler will pause after listing about 64 lines to allow manual form feeding. To continue the listing, type any character on the terminal keyboard. Control is returned to PIPBUG at the end of the listing.

The disassembler uses PIPBUG subroutines STRT, GNUM, BOUT, AGAP, CRLF, CHIN, COUT and FORM. It was written by Ian Binnie, with modifications by the author.

6. TAPE MEASURE

If you acquire a program on paper tape or cassette in Signetics Absolute Object Format, it is usually easy enough to feed it into your system and try it out. However in order to list it or disassemble it for analysis, one needs to know its length or the range it occupies in memory. This program is designed to read programs stored on paper tapes or cassettes, and print out the memory range of each block. It prints out this information at the end of the tape or cassette, as a small table having one line per block.

The program occupies the range 440 — 4FE, and is not easily relocated. It also requires RAM buffer area above 4FE, for storage of block start and finish addresses during reading. Four bytes of storage are required for each block on the tape to be measured. To use the program, simply call it by typing G440r,

then feed in the tape or cassette to be measured.

Please note that the program lists the ends of blocks as one location in memory higher than their true position, so that the block ends listed should be decremented to find the true ends.

The tape measure program uses PIPBUG subroutines CHIN, BIN, STRT, COUT and BOUT. After printing out the block information at the end of the tape or cassette, it returns control automatically to PIPBUG. It was written by the author.

7. DUMP FOR AUTO-START

This routine duplicates the function of the dump routine in PIPBUG, except that it allows you to produce program tapes or cassettes which begin executing automatically as soon as they have been loaded into your system using the PIPBUG load routine.

The routine currently occupies the range 0E60 — 0EF7, but may be moved anywhere in page 0 by changing the contents of the last two bytes. These currently contain the branch address 0E7C, and if the routine is moved they must be changed to contain the corresponding address.

To use the routine, type GE60sAAAAsBBBBsCCCC, where AAAA and BBBB are the start and finish of the memory range to be dumped, and CCCC is the address at which automatic starting of execution is to occur upon loading. Then turn on the tape punch or set the cassette recorder for recording, and finally type a carriage return. The routine will return control to PIPBUG after performing the dump.

The routine uses PIPBUG subroutines STRT, CRLF, COUT, GAP, and BOUT. It was written by the author.

8. 300 BAUD BINARY DUMP

This program is designed to dump programs onto cassette tape, in binary format and at 300 baud, so that they may be reloaded into your system considerably faster than with the 110-baud Absolute Object Format used by PIPBUG. This gives roughly a six times reduction in loading time, for the programs themselves.

The program provides two main options. Programs may be dumped alone, or preceeded by a bootstrap loader. If preceeded by the bootstrap loader, binary cassettes may effectively be loaded using the normal PIPBUG load routine. If dumped without the bootstrap, binary cassettes must be loaded using the following binary loader.

For dumping programs with the bootstrap preceeding, the following binary loader must be resident in memory, because it is used as the bootstrap source.

Dumping programs with the boostrap loader preceeding them does increase the loading time, tending to reduce the advantage over normal PIPBUG dumping and loading. However it saves having to load in the binary loader in advance. And the increase in loading time is really only significant for very short programs; even programs as short as 256 bytes still load in little more than half the normal time (39 seconds compared with 68 seconds). For large programs the loading time either with or without the boostrap is drastically reduced: an 8k memory dump can be reloaded in 5½ minutes, compared with over 30 minutes with PIPBUG.

A further option provided is for the dumped program itself to be set for automatic execution after being loaded.

The binary dump routine occupies 1200 — 12FF and cannot easily be relocated. Its starting address for dumps preceeded by the bootstrap is 1204; for dumps without the bootstrap start at 1223. Call by G1204sAAAAsBBBBr (or G1223sAAAAsBBBBr) for non auto-start of the dumped program, or G1204sAAAAsBBBBsCCCCr (or G1223sAAAAsBBBBsCCCCr) for auto-starting, where AAAA and BBBB are the start and finish of the program being dumped, and CCCC is the address for auto starting.

The routine uses PIPBUG subroutines STRT, GNUM and CBCC. It was written by Ian Binnie.

9. 300 BAUD BINARY LOADER

This routine is designed to load programs into memory from 300-baud cassette recordings made using the preceeding dump routine, when the cassettes do not have the loader already present as a bootstrap. It is also used by the dump routine as a source for the bootstrap. It occupies 440 — 497, and cannot easily be relocated. Call by G440r. Written by Ian Binnie.

10. NIM GAME

A simple version of the traditional computer game of strategy. When called by typing G440r, it announces itself and explains how to play the game. It occupies 440 — 588. The version presented has been adapted by the author from a program written by Perry Brown.

11. NUMBER GUESSING GAME

Another simple game of strategy, for amusement and diversion. Like the Nim game, it announces itself and explains how to play. It occupies 440-59F, and is called by typing G440r. The version presented here has been adapted by the author from a program written by Perry Brown.

Programs 3, 5, 8 and 9 are presented by permission of the 2650 Users' Group and Applied Technology Pty Ltd, and we thank them for their courtesy in allowing us to do so. Further information on these programs is available to members of the Users' Group. If you are interested in joining the group, its address is 109-111 Hunter Street, Hornsby, NSW 2077. Initial membership costs $40, for which you get a documentation package with hexadecimal listings of many other useful programs.

Incidentally, we aren't able to supply hexadecimal or source listings of the programs on the record. However this should be no problem, because you can produce hex listings and mnemonic listings of them for yourself, using the hex listing routine and the disassembler program on the disc itself! Both of these programs will happily process themselves along with all of the others, too — so that you can make the hex listing routine list itself, and the disassembler disassemble itself . . .

In short, we think you'll find the 2650 Software Package Recording very handy, and good value at the price. If you agree, why not fill in the order coupon below and send it in with your remittance?

MAINTENANCE
is your introduction to THE TIME-LIFE LIBRARY OF BOATING

TIME LIFE BOOKS

Large 28cm x 21.5cm size • 176 pages in each volume • Over 250 photographs, charts, diagrams per volume • Hundreds of how-to illustrations • Elegant, real linen binding with colour insets • And much more!

put out to sea with confidence

From doing it yourself, to judging repairs done for you, topnotch skippers show you how to keep your boat shipshape — in *Maintenance*, your introduction to THE TIME-LIFE LIBRARY OF BOATING.

Clear, easy-to-follow instructions, diagrams and photographs show you how to service a winch, rudder, or wheel-steering rig . . . repair damaged sails, spars and rigging . . . varnish brightwork . . . wash, dry and store sails . . . replank a wood hull . . . install safe marine wiring . . . patch punctured or cracked fibreglass . . . lay up for the winter . . . and save hundreds of dollars in hauling out costs, painting and hull care.

Each book in this extraordinary boating series gives you the most up-to-date and reliable information available today. In *Navigation*: how to plot courses against tides and currents . . . the most efficient use of compasses, dividers and depth finders . . . the special uses of omni, radar, loran and RDF . . . negotiating a narrow channel . . . piloting with dead reckoning. In *Boat Handling*: procedures for locking through . . . the right way to pilot through an inlet . . . docking techniques . . . and how to get unstuck if you run aground. In *The Handy Boatman*: instructions for adding extra lighting, new plumbing . . . and installing a VHF radio, a gas detector, or bilge-water alarm.

Use the introductory volume, *Maintenance*, free for two full weekends and see for yourself. Just return the coupon below — today!

All-encompassing, up-to-date, practical — and the most beautiful boating library ever published.

THE TIME-LIFE LIBRARY OF BOATING

Try the introductory volume MAINTENANCE free for two full weekends.

MAIL THIS COUPON NOW!

TIME LIFE BOOKS **To FREEPOST 4*, TIME-LIFE BOOKS Box 3814 G.P.O., Sydney, N.S.W. 2001.** 7966-05

YES! I would like to examine *Maintenance* free for 10 days. Please send it now and enter my subscription to the TIME-LIFE LIBRARY OF BOATING. I need send no money now and only if I decide to keep *Maintenance* will I pay just $13.95 plus $1.50 postage and handling. I will then expect to receive further volumes in the *Library of Boating* series approximately every other month for the same price and on the same 10 days free examination basis. There is no minimum number of books I must buy and I may cancel my subscription at any time simply by notifying you. If I return *Maintenance* within 10 days my subscription will be cancelled and I will owe you absolutely nothing.

Name _____
(please print)

Address _____

_____ Postcode _____

Signature _____
(No order can be accepted without a signature)

JUST FILL IN AND MAIL TODAY

**Freepost means we pay postage—no stamp required*

Philips Television Cassette Recorder.

A remarkable new product that offers 2½ hours recording on one videotape cassette.

We live in an age that offers us a fantastic array of technological marvels. Sophisticated products that entertain and instruct us through the mediums of sound and vision. All of which we can enjoy in the comfort of our own homes.

And now Philips introduce the remarkable Television Cassette Recorder — the ultimate addition to your home entertainment centre.

Here's how it works.
The Philips Television Cassette Recorder works along the same lines as a conventional music cassette recorder. But, in addition to sound, it records colour pictures. And it can be connected to any colour television receiver to play back cassettes up to 2½ hours duration.

Direct Recording.
We all have our favourite programmes which we would love to see again and again. With the Philips Television Cassette Recorder it's now possible. Simply press a button and the machine will record your favourite programme directly as you watch it.

Parallel Recording.
You know how it happens. You want to watch a programme on one channel and somebody else in the family has picked out a show on another. But with the Philips Television Cassette Recorder, a peaceful solution is at hand. You simply turn your TV to one channel, then select the other channel on the Recorder and set it to record. So as your family enjoys their programme, yours is being recorded simultaneously on cassette — even though it's on a different channel.

Unattended Recording.
Another fantastic feature of the Philips Television Cassette Recorder is that it can be pre-set up to 3 days in advance, to record any programme at any given time. So, if you're out for the evening or away at the weekend, you don't have to miss out on your favourite show. It's just a matter of selecting the right channel and setting the timer on the Recorder to the commencement time of the programme.

Some technical information.
The Philips Television Cassette Recorder allows you to record from any Australian television channel — UHF or VHF. And it's equipped with automatic fine tuning. Like audio tapes, the video tape cassettes that the recorder uses may be erased and re-recorded time and time again.

Conversely, if you wish to retain the taped programme, you can replay your Philips videotape cassettes up to 500 times. As an optional extra, there are also video cameras available for connection to the Television Cassette Recorder. Ideal for making your own home movies.

For free brochure on the Philips 367 1083 (E) Television Cassette Recorder or name of nearest retailer, write to:
Philips Consumer Products Division, P.O. Box 308, Clayton, Vic. 3168

Name.....

Address.....

.....

Postcode.....

It'll change the way you look at TV.

(The recording of television programmes is permissible only where copyright or other rights of third parties are not infringed. This advertisement should not be taken as authorising the recording of copyright material.)

PHILIPS

We want you to have the best PHILIPS

367 1083

Classical Recordings

Reviewed by Julian Russell

Liszt — Complete Concert Paraphrases on Operas

LISZT — Complete Concert Paraphrases on Operas by Verdi. Claudio Arrau (piano). Philips Stereo Disc 6500 368.

I find I have overlooked this fine disc for several issues and now review it at this late stage because of its general and particular interests. In the first place, the form of these pieces has its own interest. Liszt developed the Concert Paraphrase from the older type of transcription. The latter usually went no further than to transcribe from one or several instruments to another, with a minimum change of form. Often, a few "twiddly bits" were added.

For all that, transcription has an honest history. Even in our own era J. S. Bach himself was an enthusiastic transcriber.

Liszt made significant changes in his Paraphrases by taking, as a rule, one theme from a work — or aria in the case of opera — and while using its easily recognisable tune or tunes used the music to create another, entirely different type of composition.

He would often start his paraphrase with a phrase taken from the middle and not the beginning of the music he was about to transform. The famous Rigoletto is a good example of this. It is based on the justly renowned quartet in the last act and Liszt takes his opening bars from somewhere about the middle of the piece. If you are used to only the old type of transcription the effect is electrifying.

The whole piece is full of bravura passages used not only because of their decorative value, but because during the 18th and well into the 19th centuries, audiences at recitals demanded as a sort of encore an exhibition of pure virtuosity, often in the form of an extemporisation. Not even Mozart or Beethoven could escape these demands.

Liszt's best Paraphrases were written about the middle of the 19th century, three of them (those on Side 1 of this disc) during the year 1859. Since all the paraphrases on this disc are on Verdian subjects, it is a pity that the greatest of all his works in this form, the Don Giovanni Paraphrase, is not included.

Those on Side 1 include the Rigoletto, Ernani and Il Trovatore. In these, Liszt often takes scraps of phrases from here and there and expands and develops them while always keeping them recognisable. Each paraphrase has a form of its own, firmly and logically constructed, and if you are hearing them for the first time I can promise you many pleasant surprises.

There has always been a close association between Claudio Arrau and the music of Liszt. Indeed Arrau studied under one of Liszt's own pupils and at the early ages of 16 and 17 twice won the Liszt Prize for piano playing, a great award in those days. Arrau's understanding of Liszt's complex make-up is deep, his technique more than adequate to overcome any difficulties in the compositions. In fact during the early part of his career it was his playing of Liszt that first won him worldwide acclamation.

Dear Mr Russell,

You write in the February issue of "Electronics Australia" that you have been unable to verify whether the Bartok stage works receive regular performance in Hungary.

As one Bartok admirer to another, I am happy to tell you that having studied for two years in Hungary, I can verify that the three works are given almost every year by the National Opera Company (of the two companies, that which presents operas in their original language) and that all three are given on one night, like Puccini's Trittico, about 10 times in a season. Apart from this there are regional performances of one or another of the works, at irregular intervals.

Audiences are, as might be expected, about one-fourth tourists. The standard of dancing is quite high and so are the singers in Bluebeard although the quality of the orchestral contributions leaves a lot to be desired, specially by Boulez standards.

Thanking you for your intelligent record reviews, I am sincerely yours,

Gustave Fenyo, Pianist,
Concord, NSW.

Although it should not be taken as evidence of a meretricious turn of mind in this great pianist's nature, I would remind readers that Arrau has just finished recording a great mass of Beethoven's piano music in one of the best "integrals" on the market. And braver than most of his rivals he now and again includes one of the Liszt Paraphrases as an extra to his printed program of the recital. There are not many pianists in his class who would even consider doing this nowadays. They might even go so far as to think it trivial.

As I mentioned above, he starts the disc under review with the splendid Rigoletto piece. I might add that I have never before heard it played more brilliantly or sensitively. (Arrau today is in his middle 70s).

He makes no effort to imitate the quality or even the phrasing of the vocal part of the quartet. His playing of it is always purely pianistic. The second piece, on Ernani, though often more sombre than its predecessors, receives the same peerless treatment. I am not exaggerating when I write that I cannot imagine the now legendary Liszt playing it better himself.

The Trovatore which follows was composed for the then famous pianist-conductor Hans von Bulow, who was closely associated with Richard Wagner who characteristically didn't hesitate to steal his wife Cosima from him. In passing I might add that wife Cosima was an illegitimate daughter of Liszt, another generous patron of Wagner, though this relationship naturally became a little strained after this incident.

The Miserere, on which the Trovatore is based, is a terrific work, though Arrau uses a slightly revised edition of it here. The first side ends with the short Salve Maria from I Lombardi.

In the Aida on Side 2, Liszt completely changes the trumpet tune in the Triumph Scene at its first appearance, but preserves its rhythm. In the second theme in the paraphrase he uses the sacred dance of the priestesses, just as Verdi wrote by way of contrast. In this, written some 20 years after the three noted above, some of Liszt's ex-

uberance for this form of composition seems to have left him. The inspired melodic transformations are still there and you will still hear plenty of virtuoso passages, but his treatment of the wonderful final duet seems somehow out of context and not entirely in sympathy with the original.

The Festival Chorus and Funeral March from Don Carlos and Reminiscences of Simon Boccanegra complete this superb recital. Here is a disc to be enjoyed by high-brows and middle-brows alike which, though in later works compositionally not up to the standard of the earlier pieces, is best summed up in the final sentence of Alfred Beaujean's sleeve notes: "Whatever the case, Claudio Arrau's portrayal of this music should correct many fixed opinions and erase ingrained prejudices."

☆ ☆ ☆

SIBELIUS — Symphony No. 1 in E Minor. Boston Symphony Orchestra conducted by Colin Davis. Philips Stereo Cassette 7300 517.

In this cassette Davis shows his complete sympathy with the music of Sibelius by the way his solo clarinet plays the opening bars of the symphony with a kind of bleak poetry. Then follows plenty of fire in the main part of the movement. The brass comes in for its full glory in Sibelius' always wonderful writing for this department of the orchestra. Indeed Sibelius was a great scorer for every instrument. Yet if you know him only from his simple looking scores you will be amazed at what you hear at a concert.

Davis' first movement is cunningly calculated to excite you into the right mood to be moved by the gentle lyricism of the following andante. Davis gives it a caressing opening though there is one passage (not to quibble) just before the cor anglais' entry when he seems to be strangely carried away by the richness of the quality of the lower strings and more or less leaves the rest of the orchestra to fend for itself, so to speak. But I hasten to add that in my opinion this is the only blemish in an otherwise splendid reading.

Here and there the engineering is very good, but on the whole it does not represent Philips' usually first class sound. In particular I missed the bloom usually associated with the Boston strings, excellent though the sound is compared to some of the Bostonians' competitors.

There is plenty of snap in the scherzo though many of Davis' contemporaries use a slightly lighter touch in this movement. Yet Davis makes out a very good case for his interpretation, which is far from not having its moments of pianissimo elegance. Many might argue that the Sibelius first, a big work, is one of the finest of the late romantic symphonies — and I am not forgetting Elgar and Vaughan Williams.

It looks like Davis is about to record the complete set of Sibelius Symphonies. To me they will be very welcome.

As a fill there is a rousing performance of Sibelius' Finlandia.

☆ ☆ ☆

RACHMANINOFF — Piano Concerto No. 3 in D Minor. Lazar Berman (piano) with the London Symphony Orchestra conducted by Claudio Abbado. CBS Stereo Disc SBR 235861.

If you've heard Berman's performance of the B Flat Minor Piano Concerto of Tchaikovsky I reviewed some two issues ago, with its well judged alternations of mature power and elegant delicacy, you may well be surprised at the understatement of his introductory bars to this concerto. Yet later you will hear how it fits into his delivery of almost pallid but exquisite lyrical passages that contrast his mastodonic climaxes. These latter are the towering highlights of this magnificent performance.

Berman's peerless technique set me to thinking that this is what Liszt's must have been like. No bar, or bars, however difficult, seems to be treated with the slightest difficulty. And against this macho extroversion you have the solace of the almost childlike innocence with which he imbues many of the softer lyrical passages.

The engineering is good, though there are moments when the piano part sounds a little too forward and one misses the finer points of Abbado's exemplary playing of the orchestral part. He and the London Symphony are in great form all through this so often disparaged work, disparaged mostly by members of the avant garde whose dislike of melody and romanticism I don't have to stress here.

If you want to sample the lovely quality of Abbado's contribution just play a few bars of the orchestral introduction to the slow movement. Berman has many fine competitors in recordings of this concerto, some recent, others not so recent. But Berman's is a stunner. It just grabs you — and holds you. See what you feel after the monumental Finale!

☆ ☆ ☆

SCHUMANN — Symphonic Variations. Posthumous Variations, Papillons. Murray Perahia (piano). CBS Stereo Disc SBR 235872.

It was bound to happen sooner or later — the appearance of a real challenger to today's finest player of Schumann's piano music — Sviatoslav Richter. The pianist is Murray Perahia whose style differs from Richter's but is no less authoritative for that reason. His touch is different from Richter's though he produces the same kaleidoscopic changes in sonorities as his rival.

These variations, of course, give the performer plenty of chances to show the extent of his resources in the way of contrasts, and Perahia makes the fullest use of every opportunity. Some scintillate, some are langourous, and others are quite fairylike. But all are filled with Schumann's characteristic generosity and frequent impulsiveness.

The engineering is entirely lifelike and here again you will hear a technique of staggering accomplishment. In some of the variations, the way the melody passes from right hand to left with never a hint of change in tone or phrasing is excellent. One of the most striking features of the playing is the absolute clarity of every phrase no matter what the speed — and some of Perahia's are dazzlingly fast. There is never a hesitation or falter in any one of them.

As a bonus, on the same disc you have a delicious performance of Schumann's Papillons, a very early work of compelling charm. Listen to it and it should banish even your most churlish mood.

Lighter Side

Reviews of other recordings

Devotional Records

PORTRAIT OF RALPH CARMICHAEL. The Ralph Carmichael Orchestra and Chorus. Stereo, Light LS-5726. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals).

An endorsement on this double-fold imported album by Billy Graham recalls that Ralph Carmichael began his close association with the Billy Graham team in 1952, when he became musical director of the film "Mr Texas". Since then, with his many compositions, his musicals and his talented conducting, he has set the standard for a whole new wave of gospel music.

His own personal notes indicate that he has had a christian background since childhood but one that has afforded him a contact with a wide range of human problems and emotions, which he has been able to re-express through his music.

Side 1 of the album is orchestral with the following tracks: Like A Lamb Who Needs The Shepherd/The New 23rd — Beyond All Time — Reach Out To Jesus/He's Everything To Me — All Of My Life/One Of These Days/Love Is Surrender — The Saviour Is Waiting/We Are More Than Conquerors.

Side 2 introduces the chorus in straight numbers rather than medleys: The New 23rd — While It Is Day — I Have A Friend Who Still Cares — Love Can Make The Difference — The Saviour Is Waiting. All the numbers are Ralph Carmichael compositions and do indeed provide a musical portrait. The sound quality is good and the harmonies are easy on the ear. (W.N.W.)

MUSIC OF MY 2ND BIRTH. Bili Thredford. Stereo, Good News Records, GNR-8105. (From Sacred Productions Aust, 181 Clarence St, Sydney, and other capitals).

As portrayed on the jacket, Bili Thredford is a young man with a wide smile, an Afro-asian hairdo and plenty of talent as a pop. style composer, musician and vocalist. And, in line with the title, his lyrics all have to do with his christian convictions.

However, the predominantly rock style program, with the usual array of instruments and backing vocals, will appeal only to the rock generation.

Bili Thredford appears to have had a hand in the words and music of all the numbers: Hallelujah Song — Reaching Out To Me — Lies — I Just Wanna Thank You — We Really Missed You — Remember Me — Finally Found Each Other — Dayspring — Back Out In The Streets.

If your interested, don't worry if the titles are unfamiliar; the lyrics are set out in full on the internal sleeve. But don't buy it as a present for the old folks; that is unless your idea is that they'll hand it back to you, to play yourself! (W.N.W.)

COMPANY ADDRESSES: Some of the albums reviewed in these columns from time to time are on labels which may not be known to local music shops. In most such cases we include an address from which the albums can be ordered, either direct, or by local record and music supply shops.

Instrumental, Vocal and Humour

TRIBUTE TO WOODY GUTHRIE. Seona McDowell. 7-inch EP, stereo 45rpm. Crest International CRIN-EP-77.

Woody Guthrie, who wrote 1000 songs in the period 1936-1954, died of Huntington's disease, an hereditory disease of the nervous system, which cannot be diagnosed in early life and is impossible to cure when it is identified. Woody's life story was told in the film "Bound for Glory" and at its Australian premiers, talented New Zealand folk singer Seona McDowell who was featured on stage, met his widow, here to encourage research and support for the afflicted.

In this gentle recording, Seona McDowell sings four of Woody Gutherie's songs, accompanied by children from the Belfield primary school, Ivanhoe West, Victoria: This Land Is Your Land — Deportee — My Daddy Flies A Ship In The Sky — So Long, It's Been Good To Know You.

If you want to buy a copy and at the same time assist in the fight against the disease, which affects all races in Australia, send $2.50 to: The Secretary, AHDA, c/- 43 Barter Crescent, Forest Hill, Vic. 3131. Tel: (03) 878 3953. (W.N.W.)

☆ ☆ ☆

THE OTHER SIDE OF MIDNIGHT Sound Track Music from the movie of the same name. Composed and conducted by Michel Legrand. 20th Century L 36463. Festival release.

Unless you are a movie theme buff I can't see anyone raving over this

record, the music is pleasant enough, more in the "wall-paper" music class, suitable for a quiet evening's background, but that's about all. The elaborate jacket gives some detail in pictures of the movies' basic story line and lists the twelve tracks making the record's content. The quality however is much better than the usual soundtrack record. (N.J.M.)

☆ ☆ ☆

ANDRE PREVIN & The London Symphony Orchestra. Stereo, RCA VICTROLA VICS 1751.

If you know of someone with an awakening interest in the classics, records such as this would make an excellent start for a collection, including as it does composers such as Prokofiev, Satie, Mendelssohn, Ralph Vaughn Williams, Rimsky-Korsakov, and Richard Strauss.

Reviews in this section are by Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), David Edwards(D.W.E.), Greg Swain (G.S.), and Danny Hooper (D.H.).

LIGHTER SIDE

Most of the music is well known in the classical repertoire, with Prokofiev represented by his Symphony No. 1 in D (the Classical) and Rimsky-Korsakov by "The Flight Of The Bumble Bee" and "The Young Prince and The Young Princess" from "Scheherazade". From Satie we have the "Gymnopedies I"; from Vaughn Williams "The Wasps" overture; from Mendelssohn the "Ruy Blas" overture, and "The Rosenkavalier Waltzes" from Richard Strauss.

The review record was of excellent quality. (N.J.M.)

☆ ☆ ☆

CLASSIC ROCK. The London Synphony Orchestra and The Royal Choral Society. RCA Records VPL1 4056.

This record is quite an eye opener (or should that be ear?). Ten tracks, lifted straight from the top of the hit parade, are presented by the London Symphony Orchestra and the Royal Choral Society. The composers represented include Lennon/McCartney, Jagger/Richard, Justin Hayward and Gavin Sutherland, to mention only the best known.

"A Whiter Shade Of Pale" seems even better in the version presented here than it did in the original, while "Paint It Black" is just as you would expect it to be, with the melody picked out by massed strings. Just beautiful.

In conclusion a thoroughly recommended record, which I am sure I will enjoy for a long time to come. Recording quality is excellent, with a good stereo balance. (D.W.E.)

☆ ☆ ☆

WEEKEND RENDEZVOUS. Racing Cars. Chrysalis L 36345. Festival release.

Racing Cars are a relatively unheard-of group. Their talent lies somewhere between that of "The Little River Band" and "The Eagles" and their style of music can be summarised as "country-rock".

The five members of the band are all vocalists and some excellent harmonising develops. Even so they seem to lack a certain zest which is possessed by "The Little River Band" and "The Eagles".

Four good tracks from the ten on the album are: Down By The River — Didn't I Tell You-Weekend Rendezvous (title track) — Backwater Road. (D.H.)

☆ ☆ ☆

THE CLASSIC PERFORMANCES OF TEN YEARS AFTER. Ten Years After. Chrysalis L 36179. Festival release.

As far as I know, Ten Years After are now defunct (maybe it's ten years later!), so this record will mainly be of interest to collectors. All tracks have been released previously, and are as follows:— I'm Going Home — One Of These Days — I'd Love To Change The World — Good Morning Little Schoolgirl — Baby Won't You Let Me Rock'N'Roll You — Rock & Roll Music To The World It's Getting Harder — Positive Vibrations — Choo Choo Mama.

Judging by the crowd noise, some of the tracks are live recordings. If you are a collector of early 1970's rock and roll, then this record would add another facet to your library. Recording quality is adequate without being exceptional. (D.W.E.)

☆ ☆ ☆

MUNICH MARINE. Munich Machine. Interfusion. L 36320. Festival release.

This is an introductory album for "The Midnite Ladies". It was recorded in Munich and produced by Giorgio Moroder and Pete Bellotte, who are both powerful in the disco scene.

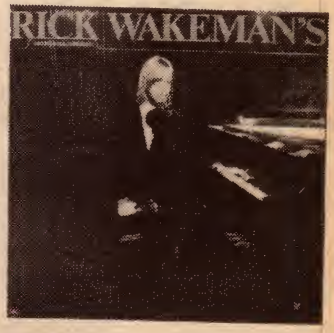
Naturally, the entire album is disco. Side one is entitled "Get On The Funk Train", but this track is of a low standard compared with side two, which includes six tracks all merging together to form a continuous beat. Included in these tracks are "The Midnite Ladies" interpretation of Donna Summer's first hit, "Love To Love You Baby" and also a song from the first album by Giorgio, "I Wanna Funk With You Tonite".

This debut album is not a brilliant success for "The Midnite Ladies", however success may be accomplished with their second attempt. D.H.

☆ ☆ ☆

RICK WAKEMAN'S CRIMINAL RECORD. Rick Wakeman. A & M Records. L 36315 Festival release.

Rick Wakeman's sixth album is built around the theme of crime and is predominantly instrumental. His talent is revealed through the use of more than a dozen keyboards and synthesizers.



To emphasise the criminal theme, the album's centre cover contains informative notes on: The Statue Of Justice — The Chamber Of Horrors — The Birdman Of Alcatraz — The Breathalyser — Judas Iscariot, all track titles. The sixth track is "Crime Of Passion".

All tracks were written, composed, performed and produced by Rick Wakeman. (D.H.)

TONY FENELON EXCELLS

MAKING LOWERY MAGIC. Tony Fenelon. Stereo, Harlequin (Festival) L-25309.

Melbourne organist Tony Fenelon is featured most frequently playing old-time pipe Wurlitzers in the old-time way — something he does with consumate skill.

In this album he reveals an entirely different facet of his capabilities as a musician. The instrument is a Lowrey C500 "Celebration Symphonic Console", which sounds pretentious until you hear its ability to imitate, not only the sound of single instruments but its simulation of complex sounds like massed strings. Nor does it end there. The C500's simulation of the traditional Wurlitzer is unsurpassed — at least as judged on record.

Tony Fenelon is, or course, completely at home playing the organ in this latter role but he also exhibits outstanding ability creating instrumental and orchestral sounds, as well as a brilliant double recording on piano of his showpiece "Ghost Riders In The Sky".

The titles: Mah-Na-Mah-Na — Swingin' Safari — These Foolish Things — 100,000 Songs — Strike Up The Band — Pago — Ghost Riders In The Sky — Song For Anna — The Masterpiece — New World — Nola.

Matching the performance, the sound quality is first rate and, all told, it adds up to an album which is a "must" for anyone with an interest in the organ. And, if you're not an organ fan, you'll still enjoy it! W.N.W.)

JOIN THE COUNTRY CLUB. Marvel Felts. RCA ABCA44024.

If you fancy some fine country and western music from a fine artist, then this album should fill the bill. Marvel Felts, a new name to me, gives a polished ferformance of 16 evergreen C & W songs, all of which add up to a very enjoyable listening session. The unnamed backing group does a fine job also.

In summary, an album that should find ready acceptance with most C & W fans.

The track titles are: Drift Away — I Want to Stay — Fraulein — When Your Good Love Was Mine — Foggy Misty Morning — Look Homeward Angel — Compliments of My Heart — She Loves Me Like A Rock — Before You Have to Go — All in the Name of Love — My Prayer — Oh Boy — Once The Magic is Gone — Garden of Eden — Wrap My Arms Around the World — Raindrops.

Recording quality is of a high standard. (G.S.)

☆ ☆ ☆

GRAY & SPICY . . . BOOM! BOOM! Ugly Dave Gray. Crest Records (122 Chappel St, St Kilda 3182). CRIN-TV-123.

This album is just what one would expect from Ugly Dave Gray — a mixture of "half-way" bawdy songs thrown in with some of his better jokes, and all recorded in front of a live audience. It's hardly what you would call screamingly funny, though. Somehow an audio only performance is just not the same as being able to see the man himself in action.

Still, this is just the sort of album that might find a place on the turntable at a (preferably not too genteel) party.

There are ten "songs" on the album: Nobody Does It Like Me — Pennies From Heaven — Remember Me — — Chloe — Galway Bay — The Old Bazaar in Cairo — Fan-Dance Fanny — Lyn, What If Your Mother Comes In — Sing Us Another One Do — Hands.

Recording quality is quite okay. (G.S.)

☆ ☆ ☆

MAGIC FLY. Space. United Artists. L 36371. Festival release.

Space are a new band to emerge and who live up to their group name by performing on stage in spacesuits. The tone and style of the album likewise lives up to the group name and can be described as galactic-disco music. Even some of the song titles possess this galactic aura. For example, "Ballad For Space Lovers" and "Tango In Space".

"Magic Fly", the title track is the single released from the album and has made its mark on the British charts by reaching the No. 1 position.

Six of the seven tracks are instrumental with "Carry On, Turn Me On" having vocals accompanying it.

For those of you who would like an original attempt at disco, try this album. D.H.

☆ ☆ ☆

BLONDIE. Blondie. Chrysalis L 36448. Festival release.

Blondie are a New York band with Deborah Harry as the lead vocalist and star. She has been hailed as the Marilyn Monroe of punk, and the punk sound is predominant on the album.

This debut album was recorded in November '76, but did not "take off" in Australia until late '77 and early '78 due to the success of the hit single "In The Flesh". Other tracks of high potential include: X Offender — Look Good In Blue — In The Sun — Rip Her To Shreads.

In fact, nearly all of the eleven tracks are quite stunning! (D.H.)

The Australian CB SCENE

PHILIPS 470MHz CB SETS NOW COMING OFF THE LINE

Running somewhat behind the original schedule, but running nevertheless, the Australian-designed Philips-TMC UHF CB transceivers are now coming off the production line in substantial quantities. The unit pictured below was from the first pre-production batch of FM320 transceivers to be shown and field tested in Sydney.

According to a company spokesman, the initial 500 units off the production line was destined for release in Victoria, the home state of Philips-TMC. NSW Sales Manager for Philips Consumer Products, Brian Westray, was due to receive the next batch of 500 the following week and a fair number of these should be operational by the time you read this. During April, stocks will spread over the remaining states.

Whether "stocks" is the right word is open to question, however, if NSW provides any sort of a criterion. At the time of writing, still several weeks ahead of the launch date, something like half the NSW allocation has been pre-ordered, without any certain knowledge of the exact technical specifications and the exact selling price. Those who respond to the official release announcements will seemingly have to join the queue.

The price has indeed escalated from the original forecast of $300 including antenna, through "around $300" to the firm figure which has now been quoted to E.A.: $330 retail, plus the cost of whatever antenna the customer chooses to install. The transceiver is covered by a 6-month guarantee from the date of purchase.

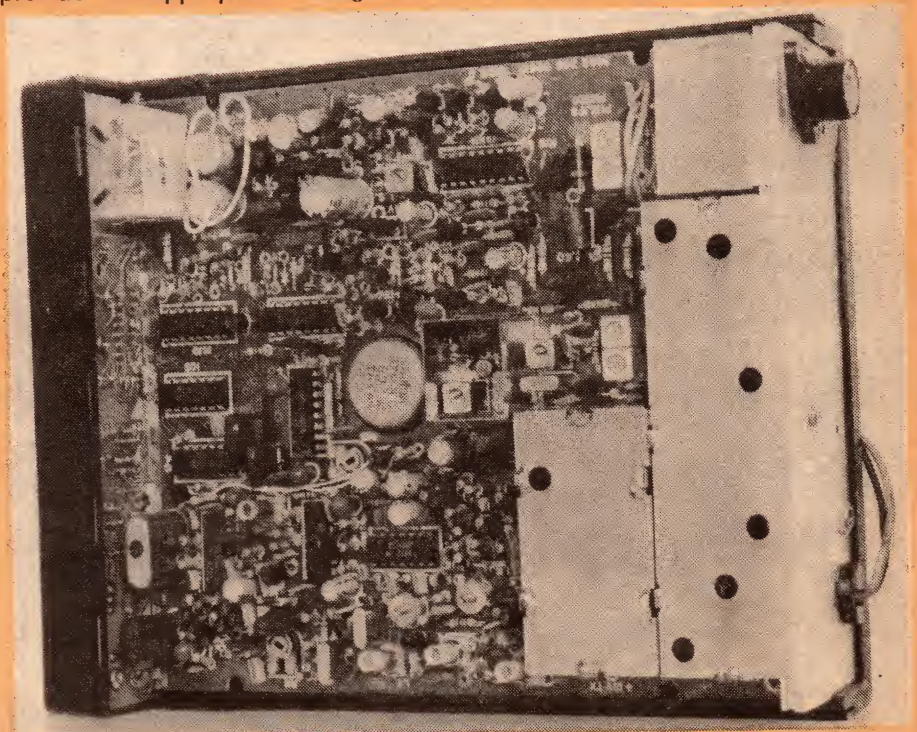
Continuing service will, of course, be available and, to this end, all Philips dealers involved in mobile radio will be involved in training sessions covering installation and repair of the new transceiver.

Initial release in all states will be through Philips dealers and car radio specialists, presumably to ensure the best possible technical back-up for the product. Later, the FM320 will become available through general CB suppliers and, in due course, through department stores. At least, that seems to be the present company thinking.

In terms of basic design, the FM320 transceiver is aimed primarily at the mobile market, as are also the antennas intended to go with it. However, it can be used for base station operation, with a suitable antenna, and with a companion mains power supply, designed to provide the appropriate voltage and current.

Electrically, the FM320 transceiver is designed to operate on any one of 40 channels between the limits of channel 1 on 476.425MHz and channel 40 on 477.400MHz. It employs narrow band frequency modulation and has a transmitter power output of up to 5.5W, depending on the exact supply voltage.

A variety of other relevant data is



At the top, a front view of the new Philips FM 320 UHF CB transceiver. Above, an inside view. There are two PC boards, one behind the panel controls (left) and the other carrying the main part of the circuitry.

given in the accompanying table.

The control arrangements reflect emerging rather than established practice in CB and other such transceivers.

There is no channel selector knob, as such; not even of the uncalibrated variety. The channel number in use is displayed by a LED readout, which is agreeably easy to read. To change channels, the operator uses either of two spring-loaded toggles — one on the panel, the other on the microphone — which cause the system to cycle through the channels in the desired direction: down towards 1 or up towards 40. The stepping rate is graded so as not to make it difficult to move one channel at a time, or too tedious to make a large excursion.

For the sequencing to operate as described, a toggle switch on the panel labelled "RESET" is left in its normal centre position. If flicked upwards against a return spring, it causes the transceiver to change instantly to channel 11, which is the nominated emergency channel for the UHF CB band.

Moved downwards, on the other hand, it switches the transceiver to any other channel which the user can specify at the time of installation. The nominated channel can be changed relatively easily, at any subsequent time, at a service depot, by rearranging a diode matrix within the transceiver. The idea is that a family, a company or a group of users can select a channel, which is hopefully not too crowded in

UHF CB CHANNEL ALLOCATIONS

UHF Channel No.	Frequency	UHF Channel No.	Frequency
1	476.425	21	476.925
2	476.450	22	476.950
3	476.475	23	476.975
4	476.500	24	477.000
5	476.525	25	477.025
6	476.550	26	477.050
7	476.575	27	477.075
8	476.600	28	477.100
9	476.625	29	477.125
10	476.650	30	477.150
11	476.675	31	477.175
12	476.700	32	477.200
13	476.725	33	477.225
14	476.750	34	477.250
15	476.775	35	477.275
16	476.800	36	477.300
17	476.825	37	477.325
18	476.850	38	477.350
19	476.875	39	477.375
20	476.900	40	477.400

The Australian CB SCENE

TEST RESULTS

1.	Current drain (Ch 11, set muted) 13.8V DC	245mA
2.	RF level for 12dB Sinad	0.38uV
3.	S-meter reading for 0.5uV pd	5 (17dB)
	S-meter reading for 1.0uV pd	9 (26dB)
4.	Modulation acceptance bandwidth	±12kHz
5.	Deviation sensitivity	±0.9kHz
6.	Single signal selectivity at 25kHz	+45dB -47dB
	Single signal selectivity at 100kHz	+59dB -58dB
7.	Total harmonic distortion (THD) at 100mW	1.5%
8.	Hum & noise relative to +3kHz/1kHz 300mW	51dB
9.	Output power for 10% (Ch 11)	1.2W
10.	Audio response 300Hz, 1kHz, 3kHz (Receive)	-4dB, 0dB, -10dB
11.	Low mute, minimum	0.12uV/1.5dB
12.	Low mute, maximum	0.6uV/21.5dB
13.	High mute, minimum	0.3uV/17.5dB
14.	High mute, maximum	2.7uV
15.	Transmitter power output (11V) 13.8V	(2.5W) 5.5W
16.	Transmit current (11V) 13.8V	(1.0A) 1.6A
17.	Transmitter spurious	Complies with RB 250
18.	Mod hum & noise (relative +3kHz @ 1kHz)Tx	41dB
19.	Mod THD +3kHz @ 1kHz (de-emphasis) Tx	4.9%

Laboratory test results for the Philips FM320 UHF CB transceiver supplied to us for examination and review. The transmitter power output is marginally above the official 5W limit for the service with a supply voltage of 13.8 DC.

their area, on which they will normally converse, as a matter of convenience.

Other controls on the front panel include a 3-position Mute switch in lieu of the usual Mute potentiometer, and Off-on switch and, of course, the main Volume Control. An illuminated meter shows incoming signal strength and relative output power, while three LEDs indicate Power On, Receive, and Transmit.

One's first impression with the FM320 transceiver is its lightness, compared with the usual 27MHz CB unit, doubtless due to the use of a high impact plastic rather than a metal case. Presumably, at the frequency involved, and with the internal shielding provided, a metal case is not necessary to counter RF radiation or penetration.

The FM320 is very compact, also: 157mm wide by 54mm high x 220mm deep, including switches and antenna socket. This, along with the very modest weight, allows the transceiver to be supported by a highly adaptable cradle, without any special need to consider weight balance.

The removal of four screws permits the top and bottom covers to be lifted away, the latter captive at the end of a short lead, because it carries the inbuilt loudspeaker.

A single wiring board is revealed, heavily but neatly stacked with transistors, ICs and other components. Towards the rear of the board are a number of metal shield compartments, presumably enclosing the transmitter RF circuitry. Knowing how recently the project was given the nod by Philips management, one cannot but be impressed by the speed with which the Philips-TMC team have got it all together.

As I write, the back-up departments are sorting out the final details for marketing, one of the last being completion of the user manual which will accompany each transceiver, in its specially styled packaging. We understand that a complete circuit diagram will be included, as is usual with Japanese HF transceivers.

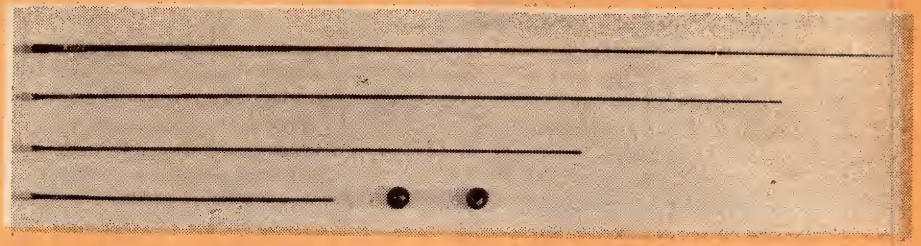
Along with the sample transceiver, Philips supplied a set of laboratory measurements; we had sufficient faith in their integrity not to want to try and duplicate them, particularly in the time available. They are reproduced, exactly as submitted, for the sake of those who like to examine and interpret figures.

We also had the opportunity to share in a brief road test with one unit in a car, and the unit as pictured in our city office, first at ground level, and later about four floors up. The antenna in both cases was a temporary 5/8-wave auto type with magnetic base and a filing cabinet to substitute for a car roof! Given the usual clutter of city buildings and the density of city traffic, the test conditions were mediocre, at best.

Even so, the system behaved just like any other VHF or UHF two-way FM channel, with a very clear, very good quality speech coming out of virtual silence for most of the time. As the car ran into shadowed depressions, noise would become apparent, the squelch would drop out two or three times and the channel would go dead until the signal built up again beyond the depression.

The Australian CB SCENE

Aerials, bases, &c, from Mexceller



Pictured above are four 27MHz helical whips manufactured by Mexceller Antenna or 34 Beauty Point Crescent, Emu Plains, NSW 2750 (Tel 047 31-6783). Largest is "Totem", 180cm (approx 6ft) long. Then comes "Hiawatta" at 155cm, "Mini Stick" at 109cm, and "Stumpy" at 60cm. The pitch of the winding is varied in all cases in an effort to ensure high efficiency with an effective 50 ohms impedance, after trimming. The winding is continuous and is secured to the rod by a special coating which does not interact with the copper and which inhibits moisture penetration. Mexceller claim that their antennas are notably strong and light, with a minimum of air drag and top-end inertia. An interesting accessory is their PAM BA permanent angle mount base which, like car radio mounts, will allow the angle of the antenna to be adjusted relative to the supporting car body panel. Mexceller antennas are marketed through Standard Components Pty Ltd (10 Hill St, Leichhardt, NSW) or through Wattmaster (W. G. Watson) agents. An instruction sheet for peaking the antennas is available.

Earlier in the day, Philips' own field tests from a vantage point on a North Sydney building had followed the signal to the Castle Hill area, some 25-30km from Sydney, lost it beyond that along the river flats around Windsor and then picked it up again as the car began to climb the face of the Blue Mountains.

From the same North Sydney vantage point, the signal appeared to penetrate very well into the coastal beaches reportedly comparing more than favourably with a 27Mhz circuit over similar paths.

In board terms, however, it is difficult to make a direct comparison between these kind of observations at with what is experienced generally on 27MHz. The lower frequency signal is less prone to topographical shadowing but it is also much more prone to noise and other station clutter. If communication on UHF is lost in particular areas, the user can predict with near certainty where it will be regained, usually with 100% readability.

27MHz working is characterised by the periodic occurrence of "skip" and the possibility of DX working. It may add interest for those who want to use their equipment in that manner but it is just one more source of massive intereference for those concerned with a local 2-way circuit.

This sort of consideration, alone, will probably be sufficient to sort the HFers from the UHFers, irrespective of whether the licencing authorities get round to doing so by legislation.

But, in the mean time, for those who want more reliable local circuit working, without the hassle of 27MHz interference, the Philips FM320 looks most promising.

☆ ☆ ☆

* A trial examination for aspiring novice amageurs: see Pierce Healy's Amateur Radio columns.

The Australian
CB SCENE

UHF ANTENNAS: MORE CRITICAL

The introduction of UHF working has opened up a whole new field in antenna technology. While it is true that the same basic principles apply as for 27MHz, physical construction and cable termination becomes far more critical.

With the inherently larger dimensions appropriate to the lower frequency, CBers on 27MHz often appear to get away with approximations and improvisations, but any resulting assumption that "near enough is good enough" certainly does not apply to UHF antenna systems.

With UHF mobile antennas, for instance, even the mounting base becomes an integral part of the antenna, affecting the overall behaviour of the system. Some mounting bases that have been used for 27MHz in the past become almost unusable, due to their physical construction.

This can be appreciated when one considers the very small physical length of mobile antennas for UHF — typically 15cm for a full quarter wave as opposed to 277cm for 27MHz. Fairly obviously, the length of the whip bolt and the unshielded portion of the cable termination can represent an appreciable part of the antenna's aperture and, if this is below the ground plane area or the roof line, it can lead to a significant loss in overall efficiency.

The availability of above roof terminating bases (Fig. 1) overcomes the problem of lost aperture. In these special bases the coaxial cable is terminated above the roof line so that as much as possible of the available power is radiated by the antenna and not by the coaxial termination below the roof. These UHF mounting bases are used quite extensively in commercial grade 400-500MHz mobile antennas today, and are generally more easy to assemble than conventional mounts.

UHF base station antennas become quite sophisticated and true gains of 6dB over that of a halfwave antenna become practical propositions. It should be realised that a 27MHz base station antenna with a true gain of 6dB would measure 72 feet in height, as opposed to 8 feet for 476MHz.

Typical of such high-gain antenna structures are the so-called collinear dipoles which consist of a series of halfwave radiators stacked one on top of each other, and fed in phase to produce an additive effect. This increases the effective radiated power, such that an antenna of this type with a gain of 6dB, when used in conjunction with a five watt set, will increase the effective radiated power to the equivalent of 20 watts.

The advantage of small physical element size can be applied equally to mobile antennas and, in fact, two-element 476MHz whip antennas are currently available developing considerable gain over the basic quarter-wave configuration.

A rather unique development designed by Scalar Industries and peculiar to Australian CB requirements is a dual-channel mobile antenna which can be used quite effectively for either 27MHz or 476 MHz. It obviates the need for separate antennas when both types of CB sets are desired. A diplexer or combiner will be available shortly which will enable this antenna to be used simultaneously with a 27MHz and 476MHz transceiver, either in receive or transmit mode, without the need for switching.

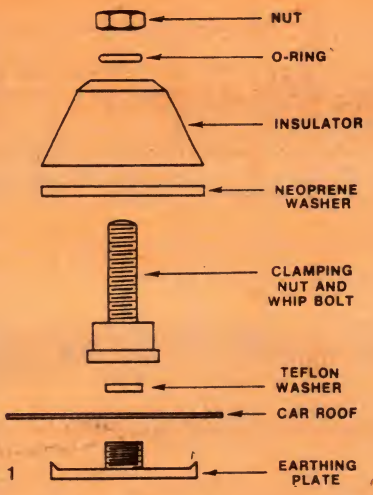


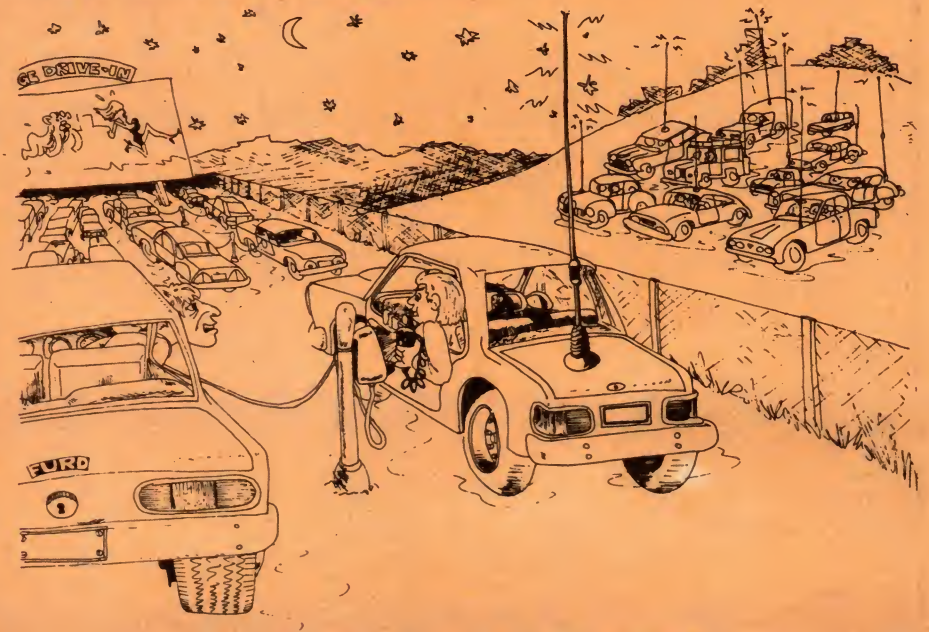
Fig. 1

Superfically, bases for UHF mobile antennas look much the same as their HF counterparts but there is an important difference: the UHF base is so designed that the feed cable comes up through the bracket work, virtually to the bottom end of the antenna proper. Wasteful radiation below the roofline is thereby minimised.

The range of antennas available to the CBer will be quite broad, and careful consideration should be given to the choice rather than buying the first antenna offered. Plenty of good advice will be available from Australian antenna manufacturers as to the correct type and proper installation of UHF antennas.

***Based on an article by Scalar Industries Pty Ltd, 18 Shelley Ave, Kilsyth, Vic 3137; Tel: (03) 725-9677. In NSW Tel: (02) 570-1392.**

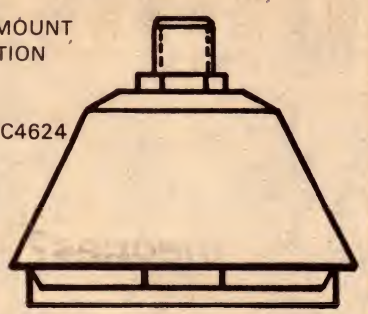
Dick Smith Contest cartoon:



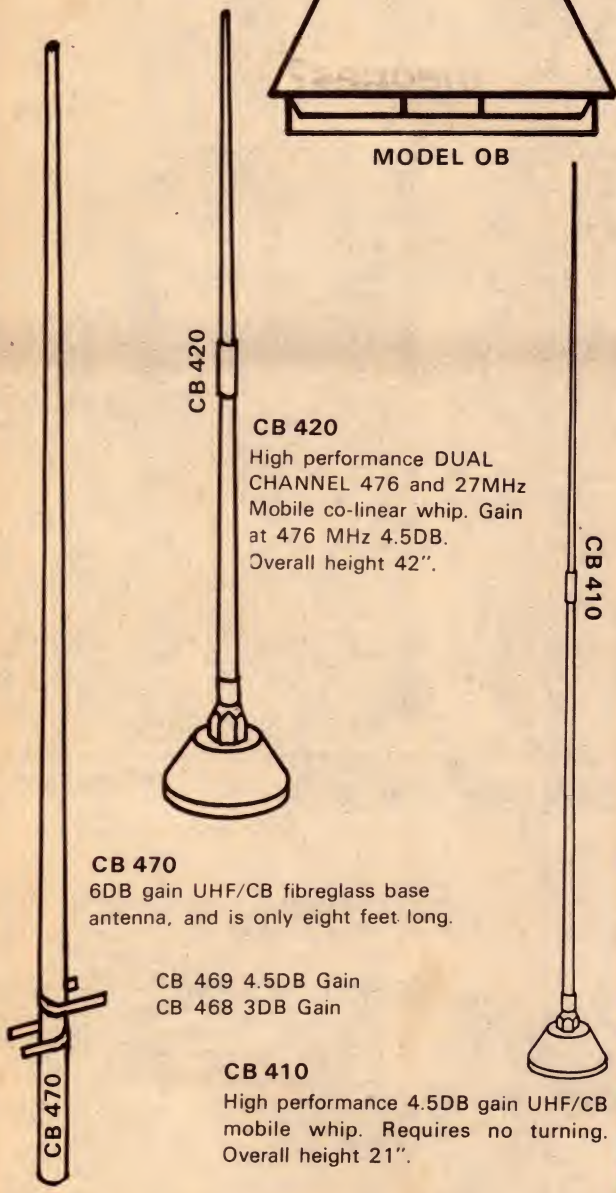
(From Stephen Angell, F1 8 Waratah Ave, Tullamarine 3043)

SCALAR UHF/CB ANTENNAS

SCALARS UHF MOBILE MOUNT FOR CORRECT TERMINATION OF COAX AT UHF FREQUENCIES.
PATENT PENDANT NO. PC4624



MODEL OB



CB 420
High performance DUAL CHANNEL 476 and 27MHz Mobile co-linear whip. Gain at 476 MHz 4.5DB. Overall height 42".

CB 470
6DB gain UHF/CB fibreglass base antenna, and is only eight feet long.

CB 469 4.5DB Gain
CB 468 3DB Gain

CB 410
High performance 4.5DB gain UHF/CB mobile whip. Requires no turning. Overall height 21".

SCALAR UHF/CB antennas and the wide range of Scalar Standard CB Antennas (from 30" to 108" long) and accessories are available from leading retailers and distributors throughout Australia.

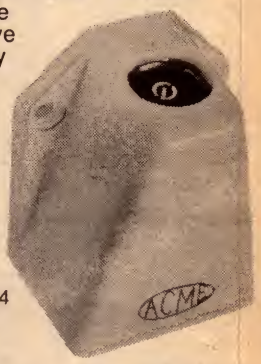
TRADE ENQUIRIES WELCOME

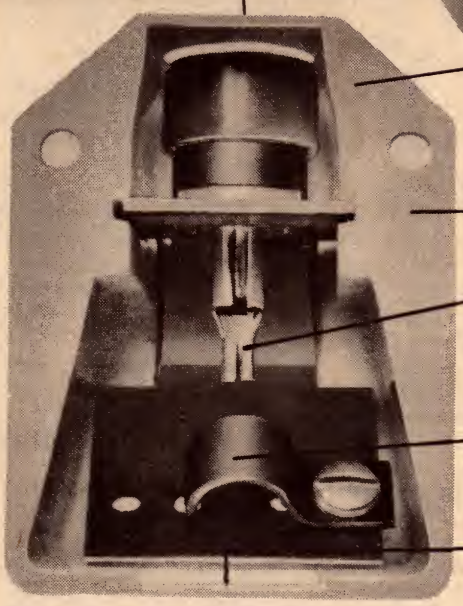
SCALAR INDUSTRIES PTY LTD

COMMUNICATION ANTENNA ENGINEERS
18 SHELLEY AVENUE, KILSYTH, VIC. 3137.
Telephone: (03) 725-9677. Cables: Welkin. Telex: AA34341.
NSW: 20 THE STRAND, PENSHURST 2222. Telephone: (02) 570-1392.
Qld: 969 ANN STREET, FORTITUDE VALLEY 4006. Telephone: (07) 52-2594.
Telex AA43007

Putting in a Plug for TV.

At last we have the opportunity of putting in a plug for ourselves. On television yet! It's our brand new 75 ohm Coaxial TV antenna outlet socket (P/N C27-24). Completely re-styled and attractively finished, the all-new ACME TV Plug is the simplest of all to install. Provision is made for either back entry or side entry of the cable and you don't have to solder either! You'll be pleasantly surprised at the ingenuity of ACME's new TV Plug and likewise with price.





Ask for the ACME 75 ohm Coaxial TV antenna outlet socket at all leading suppliers or contact the ACME office or agent in your State for further information.

ACME

ACME ENGINEERING CO. PTY. LTD.
2-18 Canterbury Rd., Kilsyth, **VIC.** 3137.
Ph. 729 6211

N.S.W.	Ph. 648 4638
A.C.T.	Ph. 95 9138
QLD.	Ph. 58 2011 (Brisbane)
	Ph. 71 4131 (Townsville)
	Ph. 51 4422 (Cairns)
S.A.	Ph. 74 1162
W.A.	Ph. 28 1022
TAS.	Ph. 34 2811 (Hobart)
	Ph. 31 5545 (Launceston)

ACME 1293

AMATEUR RADIO

by Pierce Healy, VK2APQ

Sunspot activity: how valid are current theories?

Have we really been grasping at straws to explain the cycle variant noted in radio communication? Is the widely accepted theory due for revision?

Has radio communication over the last three or four decades tended to highlight a very minor aspect of sunspot activity? Are there yet unobserved phenomena that should be looked for or has long distance radio communication become possible due to a minor solar activity? Maybe, as recently observed, sunspot cycles, are just an advertising gimmick to market amateur transceivers.

Whatever the answer may be there appears to be plenty of time for conjecture.

Amateurs are aware of the familiar 11 year sunspot cycle theory and its effect on band propagation. Now there is a new theory to think about.

In "New Scientist", 25th August 1977, is an article by Dr Keith Hindley, which indicates that the sunspot cycle is of far greater period, even up to 3000 years.

This theory, based on new studies of radio-carbon in the annual ring growth of trees, suggests that the 11 year sunspot cycle theory is abnormal behaviour. Studies of tree rings going back over 3000 years indicated that the Sun was largely inactive during this period. This inactivity was broken by only a few brief periods which are currently regarded as normal solar behaviour.

The article refers to the work of Dr John Eddy of the High Altitude Observatory, Boulder, Colorado, USA, whose investigations have extended the modern records of sunspot activity back to 1610.

The use of radio-carbon in tree rings was first suggested in the early 1960's. The importance of this correlation is that tree ring records go back for 7000 years in the bristlecone pines of California.

Dr Eddy's study covers the past 3000 years. The tree ring record clearly shows a surprising irregularity in solar behaviour. There are at least a dozen principal trends each lasting from 50 to 200 years. But instead of the record showing mainly high solar activity with an occasional minima, it shows mainly very low solar activity.

There are only a few bursts of high solar activity totalling about 10 per cent of the period since the late bronze age. These variations do not appear to have an underlying cycle but to be essentially random. The period since 1700, on which is based all our research and theory about the Sun, turns out to be abnormal.

Normal behaviour would appear to be an almost spotless Sun with minimal corona and low overall activity producing few, if any, aurorae.

Dr. Eddy's research shows that minimum sunspot activity coincides with high radio-carbon in the growth rings. Also that the times of high and low solar activity correspond to times of warm and cold European climate in the last 3000 years.

Graphs with the article illustrate the sunspot activity since 1600. From 1650 to 1715 solar activity was almost dormant, and coincides with high radio-carbon in tree rings. The sunspot number during the 1960's is the highest since about 1780.

If the 11-year cycle is an abnormal behaviour it is interesting to speculate on the effects of a dormant period on radio communication; a problem which will concern future generations of amateurs.

ELECTRONICS WEEKEND

Two courses, one for those who have been working towards obtaining a novice amateur radio licence, the other an introduction to digital logic, are being offered at Mount St Mary's Education Centre, Katoomba from 8.00pm 28th April, 1978 to 4.00pm 30th April, 1978.

The cost of this resident weekend is $15.

The convener is Reverend Bro Cyril Quinlan, VK2ACQ, on behalf of the Wireless Institute of Australia, NSW Division Education Service, incorporating the Youth Radio Service.

There is a minimum number of 40 registrations required and accommodation available for a maximum of 160 persons.

Inquiries and bookings should be made to Bill or Millie Newton, 64 Valley Road, Epping 2121. Telephone (02) 85 6321.

Closing date for registrations is 12th April, 1978.

NEW ZEALAND CONVENTION

The 52nd annual New Zealand Association of Radio Transmitters conference — known as the "Hawkes Bay NZART Conference" — will be held at Napier on the Queen's Birthday weekend, 2nd-5th June, 1978. The venues are the Wool Exchange and War Memorial Hall on Napier's Marine Parade.

The expected total attendance is about 300 persons.

In addition to the business discussions of the NZART annual general meeting, there will be demonstrations and displays of equipment, field contests, sightseeing tours, an official dinner and dance on Saturday evening, and a social evening on Sunday.

Registration fees are: $27 — full program; $17.50 — full Saturday only program; $15 — all except dine and dance; $12 — dinner and dance only; $6 — Saturday daytime only.

Conference award: During the period 1st May to 4th June, to help to

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown 2200.

Australia's TOP ham supplier

the FAMOUS MACHINE !

IT'S CRYSTAL CLEAR! The Icom IC22S synthesised 2m FM mobile transceiver features programmable ROM for any frequency multiple of 25KHz from 146 thru 148 MHz. Your new IC22S comes complete with 90 day warranty, mic, mobile mounting bracket and instruction manual. $279

It's Crystal Clear

DIGITAL IC-245

The IC245 fm mobile is synthesised with 4 digit readout. Covers 144 thru 148MHz in 5KHz steps!

STATE OF THE ART

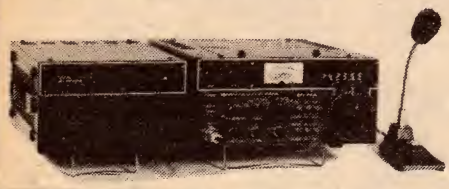
NOW $450

ALL-MODE for TWO

NOW $750

ICOM IC211 2m fm transceiver
The new IC211 from VICOM is the last word in digital 2m, all-mode transceivers. Fully synthesised in 100Hz or 5KHz steps, has dual tracking, optically coupled VFOs with 7 digit LED readout. One knob controls all frequencies. Modes fm, usb, lsb, cw. Internal 240vac and 13.8vdc power supply. Comes complete with VICOM 90 day warranty.

ICOM'S DIGITAL ALL SOLID STATE HF TRANSCEIVER



- All Solid State, even the finals.
- 100W Continuous Duty on All Bands, All Modes.
- All Bands 1.6 ~ 30MHz.
- USB, LSB CW, CW-N(Narrow), RTTY.
- Double Balanced Schottky Diode Mixer used in both receive/transmit.
- Dual Split-in individual Digital VFO's offer split frequency operation.
- ICOM's unique Pass Band Tune.
- VOX, Semi break-in CW, RIT, AGC, Noise Blanker.
- Built-in Speech Processor
- Full Metering
- Extremely compact.
- Digital readout and all filters built in.
- Built in DC power supply.
- Optional AC power supply/speaker.
- Full line of accessories to come.

IC701

ICOM

IC701 TRANSCEIVER $1160
IC701PS optional AC supply $239

THE ULTIMATE

IC202E 2m ssb portable transceiver	$ 219
IC502 6m ssb portable transceiver	$ 219
IC245 2m fm digital mobile transceiver	$ 450
IC215 2m fm portable with 9 chs. installed	$ 219

MICROPHONES

VM-1 ptt lowZ, noise-cancelling	$8.90
VM-2 base with preamp. low Z	$29.80

MORSE KEYS

HK702 deluxe key with marble base	$ 35
HK708 economy key	$ 19
HK706 operators key	$ 20
MK701 manipulator	$ 29
EK103W electronic keyer	$ 159

Antennas!

You know you can count on

hy-gain

Hy-Quad 2el 10/15/20m	$ 299
TH3Jr tribander, 3el	$ 199
TH3MK3 3el, 10/15/20	$ 269
18AVT/WB 80-10m trap vertical	$ 139
14AVQ/WB 40-10m trap vertical	$ 99
TH6DXX Thunderbird 6el tribander	$ 345
204BA 4el 20m monobander	$ 249
203BA 3el 20m monobander	$ 190

TWO METRES

ARX-2 Ringo Ranger base antenna	$49
AS210BN twin 10el 2m beam	$ 119
42S ¼ wave mobile whip with cable	$14
82D wave mobile whip with cable	$26

TRAP VERTICALS

V5Jr 6.7m high, 80-10m, no guys	$ 129
V4Jr 4.25m high, 40-10m, no guys	$ 95

TRAP DIPOLES

Midy VNB 80 thru 10m, 23m long.	$ 99
AL48DXN 40/80m, 2Kw pep max.	$ 59

Warning: The law requires that a licence be held for all transmitting equipment. Purchasers may be asked to provide evidence that he/she is the holder of an appropriate certificate of proficiency. Prices and specifications are subject to change without notice.

KENWOOD

TS820S HF digital transceiver	$1105
TS520S HF digital transceiver	$ 705
VFO820S vfo for TS820S	$ 155
TV502 2m transverter	$ 260
TV506 6m transverter	$ 229
MC50 high Z desk mic.	$ 55
MC10 high Z hand ptt mic.	$ 15
TL922 linear amplifier 2Kw input	$1045
AT200 Antenna coupler	$ 159

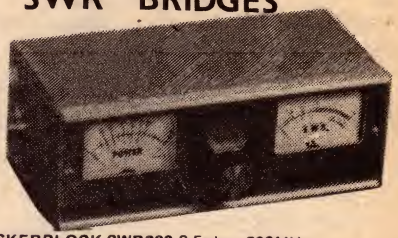
YAESU

FT101E HF transceiver	$ 849
FT7 HF mobile solid state	$ 569
FL2100B HF linear amplifier	$ 578

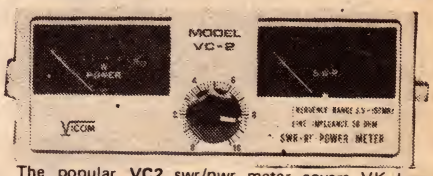
DAIWA RF SPEECH PROCESSORS
Daiwa have introduced a new range of RF speech processors which are simply attached into the microphone line. Two new models are available, model **RF440** which features a phase shift network and model **RF550** which utilises a crystal filter. The processors are a suitable alternative to a linear amplifier – up to 6dB gain (4 times) improvement on the signal can be expected! Both models feature 240vac/13.9vdc operation and include compression level monitoring via a front panel meter. Impedance is switchable 50K/600ohms with distortion better than 3%.

Model RF440 (phase shift)	$119
Model RF550 (crystal Filter)	$159
Model MC330 (audio compressor)	$71

QUALITY SWR BRIDGES



OSKERBLOCK SWR200 3.5 thru 200MHz, 2/20/200/2000w pwr $ 75



The popular **VC2** swr/pwr meter covers VK ham bands plus CB. Each unit fully calibrated for high accuracy with power measurements 12/120w. Complete with informative instructions. Price **$34.**

SW410A 140 thru 500 MHz, 20/120w, direct reading – no freq. adjustment required $ 99

SW210A 1.8 thru 150MHz 20/200w, direct reading $ 79

LOW PASS FILTERS

FD30M 32MHz cut-off, 1Kw max.	$ 30
FD30LS 32MHz cut-off, 200w pep max.	$ 20

ROTATORS

ART8000 super heavy duty	$ 478
ART3000C heavy duty with control box	$ 199
AR22XL light duty, OK for small beams	$ 109

FOR THE SWL

Yaesu **FRG7** receiver	$ 349
Barlow Wadley portable with fm	$ 339
UP-3 receiver preamplifier	$ 35
Listener-3 **antenna** for short wave	$ 49
NRD505 professional receiver	$2499

FOR PERSONALISED SERVICE & CONSTANCY Dealer enquiries invited

VICOM

139 AUBURN RD. AUBURN VIC 3123

PH 03–82 5398

Perth	446.3232	Canberra	82.3581
Adelaide	43.7981	Brisbane	38.4480
Gold Coast	32.2644	Hobart	43.6337

AMATEUR RADIO

publicise the conference, there will be an award available to New Zealand and overseas amateurs who supply proof of making a required number of contacts with amateur stations in the Hawkes Bay area. The two club stations in the area, ZL2AJB Napier and ZL2BEI Hastings, will be on the air each evening during that period.

Requirements: Contact the two Hawkes Bay club stations plus four other different mode stations located in the area on any band or mode (but no net contacts). List call signs, date, time, band and mode, have it certified by another amateur, and send to Conference Award, PO Box 4030, Napier, New Zealand by 31st July, 1978.

Thinking about making a trip to New Zealand? Why not arrange your itinerary to be in Napier for that weekend?

Further details may be obtained from the conference committee at the above address.

RADIOTELETYPE

The NSW RTTY group are producing an informative monthly newsletter entitled "AREWISE", the object being to report on the activities of the group and to disseminate technical information of interest to members.

Here from the February, 1978 issue, as reported by Bill Storer, VK2EG, are a few facets on the history of RTTY as an amateur communication mode in Australia.

The RTTY mode of transmission was developed from surplus wartime equipment in America. As far as it is known Eric Ferguson, VK3KF was its originator in Australia. For many years Eric had a "paper" war with the PMG's Department in an endeavour to operate RTTY on the Australian amateur bands.

It was not an easy matter to convince the department that this mode of operation was one of the up-and-coming means of communication. Eventually Eric was given a permit for 12 months operation in the late 1950's using F1 emission. As no equipment was available in Australia for amateur use, all his equipment had to come from overseas.

In 1960, Bill met Eric, was sold on this mode of operation and, after some frustration, obtained his permit. Bill also had to obtain equipment from overseas.

Eventually the Department granted Australian amateurs the RTTY mode of operation with no restrictions on speed and shift up to 850Hz, and with no band limitations.

During the last ten years, equipment has become more readily available and at the present time is very reasonably priced. In fact, of all the specialised communication modes used in the amateur service, RTTY is the least costly.

There are approximately 70 active amateur RTTY stations operating in Australia. Some are operating on the HF bands and working overseas stations, while others are operating on the VHF bands.

On behalf of the NSW RTTY group, a news broadcast is made each Sunday morning at 0030GMT on 7045kHz and 14090kHz under the call sign VK2TTY. This broadcast is transmitted at the international amateur speed of 45.5 bauds with a frequency shift of 170Hz.

An approach has been made to the VK/ZL contest committee asking that an RTTY section be included in the annual contest held at the beginning of October each year. Suggested rules have been forwarded to the committee.

To assist the newcomer, the NSW and West Australian RTTY groups have produced circuit boards and kits for demodulator units.

The next meeting of the NSW RTTY group will be on 7th April, 1978 commencing 8.00pm at Wireless Institute Centre, 14 Atchison Street, Crows Nest. Visitors and intending members are welcome.

TRIAL NOVICE EXAMINATION

As an aid to candidates for the Novice Amateur Operator's Certificate of Proficiency, the Victorian Division YRS will hold a trial novice examination on Saturday 15th April, 1978. The place of examination will be near the central area of Melbourne, easily available by public transport and parking facilities.

A similar exam was held in 1977 and records show that it helped to increase the pass rate to twice that of previous NAOCP exams.

A great deal of time and effort has gone into ensuring that the trial exam will be as similar as possible to the official exam. Candidates' answer sheets will be returned when marked, allowing weaknesses to be pinpointed to optimise further study time.

The exam fee is $1.00 and should be sent with your application as a postal note or cheque made out to the Youth Radio Club Scheme.

Applications should be sent to: YRCS Trial Novice Exam, 11 Vista Avenue, Kew, Vic. 3101.

The NSW trial novice exam is scheduled for 16th April, 1978. Clubs wishing to run an exam centre should advise Ken Hargreaves VK2AKH, 52 Marlin Avenue, Floraville 2280.

WIRELESS INSTITUTE NEWS

Dr David Wardlaw, VK2ADW, federal president of the Wireless Institute of Australia, attended a meeting of the International Amateur Radio Union working group in Geneva during February.

Those attending this working group meeting also saw in operation the Aeronautical Mobile Conference, a large International Telecommunication Union conference dealing with aeronautical communications. This opportunity gave them an insight into the modus operandi of ITU conferences prior to attending WARC 79.

On the way home, David visited the Radio Society of Great Britain and amateur service societies in Korea, Japan and Singapore. Discussions centred around progress being made on preparations for WARC 79.

On the local scene, discussions have taken place between WIA federal executive and the controller of the Radio Frequency Management Branch of the P & T Department. It appears that consideration will be given to a WIA proposal of setting up a joint amateur examinations committee, and it is thought that a favourable consideration may be the outcome.

Further discussion also took place on the October 1977 novice licence examination at which the standard of the theory questions were thought to be beyond the level necessary for that licence. It is believed that something will eventuate from the objections put forward.

REMEMBRANCE DAY CONTEST

The Australian Capital Territory (VK1) division was the winner of the WIA 1977 "RD" contest.

This contest is held in mid-August each year to commemorate the memory of Australian amateurs who lost their lives in the service of their country during World War II.

Points scored by the various divisions were: VK1 ACT — 111,357; VK6 WA — 105,739; VK5 SA/VK8 NT — 89,838; VK7 TAS/VK0 ANT — 89,823; VK4 QLD — 67,492; VK3 VIC — 13,383; VK2 NSW — 11,751.

RADIO CLUB NEWS

CENTRAL COAST AMATEUR RADIO CLUB: The 21st annual field day of the CCARC was again an outstanding success, with an attendance of 630 persons. The weather was fine and warm and the field events were keenly contested. Winners and placegetters were the recipients of excellent prizes worth over $1100, donated by a large number of business houses and distributors of radio and electronic equipment.

The youngest prize winner was 6½-year-old Bradley Skeers for his effort in the hidden transmitter hunts, while the very seasoned contestant Dave Andrews, VK2AWZ took out prizes in five events.

The club expresses sincere appreciation to all who made such generous donations to the prize list.

The ladies stall was very well patronised and they are to be complimented on their efforts. The disposal market had about $2500 worth of better quality equipment for sale, while the latest in amateur and electronic equipment was also displayed for sale by a number of well known distributors.

AMATEUR RADIO

Sales in all areas were reported to be good.

A visit to the Reptile Park, a coach tour of the central coast area, and a launch trip on the Brisbane Waters were also part of the day's activities.

REDCLIFFE RADIO CLUB: The annual meeting was held on 6th February, 1978 when a review of the year's activities was presented by the president, John Aarsse, VK4QA. The report indicated that some progress had been made in preparing students for amateur licence exams, but that additional help was required from licenced members.

Dave Richards, VK4UG is the RRC net controller each Sunday evening at 8.00pm EST on 3650kHz during winter months and 14.3MHz during summer. 28.550MHz is also used to give novice licensees an opportunity to acquire the points necessary for the Redcliffe City Award.

The "Redcliffe City Award" is issued by the RRC on the following basis:

Members of the RRC when contacted on the air are qualified to give one point towards the award. Contacts with the club station VK4RC, are worth two points. Australian and New Zealand amateurs require six points, overseas DX stations four points.

Applicants for the award should send two IRCs, or Australian stamps to the value of 50 cents, or money order to the value of 50 cents (Aust), accompanied by a list of the stations worked showing date, time, frequency and RST report. QSL cards for the stations worked are appreciated but not essential.

Call signs of club members as at February, 1978 are: VK4AAU; VK4AMI; VK4ASA; VK4AWR; VK4FB; VK4KL; VK4NCH; VK4NOM; VK4NCI; VK4NEQ; VK4NEX; VK4QA; VK4UA; VK4UB; VK4UG; VK4VE; VK4WX; VK4ZDE; VK4ZHO and VK2SB/4.

Applications should be sent to: Redcliffe Radio Club, PO Box 20, Woody Point, Qld 4019.

THE VK/CB CLUB VICTORIAN DIVISION: The aim of this club is to provide an opportunity for those interested in the hobby of amateur radio to contribute to the orderly development of the Citizens Radio Service, particularly in assisting the newcomer to radio communication. This will be achieved by providing an example of good operating practice and on or off air technical assistance. The club also aims to encourage CB operators to obtain the novice amateur operators certificate and to stimulate interest in amateur radio generally.

Further details may be obtained from: the VK/CB Club, Victorian Division, C/- 43 Cuthbert Road, Reservoir, Victoria 3073. A stamped self addressed

AMATEUR RADIO

envelope would be appreciated with such inquiries.

FRANKSTON & MORNINGTON PENINSULA AMATEUR RADIO CLUB: advise that there has been a change in the net frequency as given in the club directory (EA Feb. 1978).

The frequency is now 28.510MHz and the time is 2000 hours local time, Wednesday.

ILLAWARRA AMATEUR RADIO SOCIETY: In the February, 1978 issue of "The Propagator", the monthly newsletter of the IARC, Lyle Patison, VK2ALU Moonbounce (EME) Project Co-ordinatior, reports that there were 88 different EME tests scheduled during February, involving over 40 stations on all continents. The frequencies used were from 432MHz — 432.060MHz. It is also normal for a number of contacts to be made on an unscheduled basis.

Reports continue to be received of EME contacts being spoiled by interference from non-EME stations using the same frequency. The station causing the interference does not have to be in the same part of the world as either of the EME stations and probably cannot hear either of the EME stations.

The message for Australian stations is: if using other than low ERP on transmit, please do not use the EME freqiencies.

The more progressive overseas amateur radio organisations are recognising that fact and are modifying their bandplans accordingly.

During February, VK2AMW, the IARC moonbounce station at Dapto, had scheduled tests with YV5ZZ in Venezuela and W6ABN in the USA.

WAGGA AMATEUR RADIO CLUB: Over 30 persons are attending the club's novice licence training class, which is timed to prepare candidates for the November, 1978 examination.

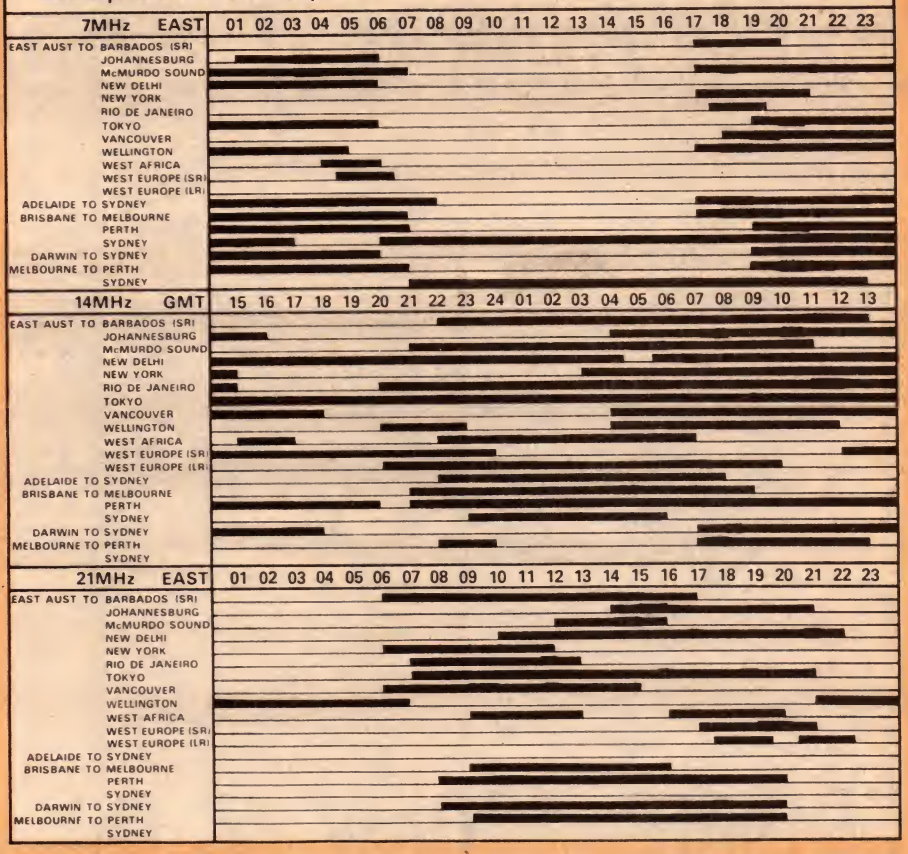
Club membership now stands at 70, and a further increase is predicted.

A letter setting out the problems associated with illegal use of the radio frequency spectrum and setting out recommendations for consideration in gaining control over the situation has been sent to the Hon. Wal Fife, Member for Farrar on behalf of WARC members.

The annual South-West Zone convention will be held in Wagga on the October, 1978 holiday weekend.

IONOSPHERIC PREDICTIONS FOR APRIL

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 4.78



AUSTRALIAN CLUB DIRECTORY

Club name: Adelaide University Radio Club.
Club call sign: VK5UA.
Meeting place: Clubroom top of Civil Engineering Building, Adelaide University.
Day and time: Thursdays 1.00pm to 2.00pm during University term. First and third Monday of the month at 8.00pm.
Affiliation: Not stated.
Net frequency: 146.0MHz FM.
Contact: Secretary, Radio Club, C/- SAUA Office, Adelaide University. 5001.

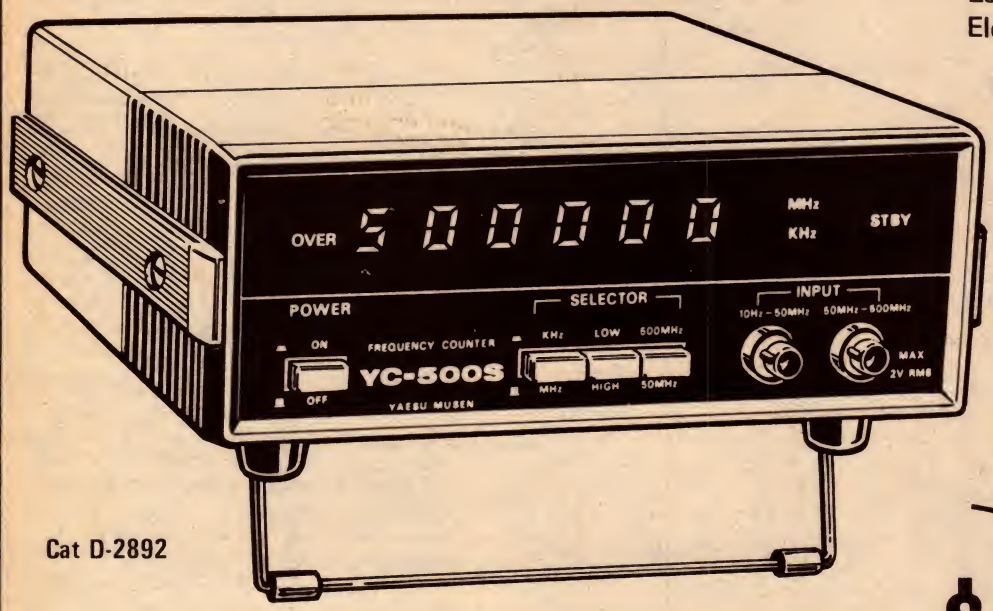
Club name: Elizabeth Amateur Radio Club.
Club call sign: VK5LZ.
Meeting place: Elizabeth East Sea Scout Hall, Hornett Crescent, Elizabeth East, Sth Aust.
Day and time: First Saturday each month at 8.00pm.
Affiliation: WIA South Australian Division.
Net frequency: Nil.
Contact: President — Tony Cooling, telephone (08) 255 2249; Secretary — Bill Thomas, telephone (08) 258 6070; Postal address — PO Box 8, Elizabeth 5112.

Club name: Port Pirie Amateur Radio Club.
Club call sign: VK5PP.
Meeting place: Club Rooms at the Airport, Port Pirie.
Day and time: First Friday of each month at 7.30pm.
Affiliation: Not stated.
Net frequency: Channel 2 FM repeater VK5RMN.
Contact: Secretary, Graham Johnston, VK5ZGJ, 25 Square Street, Port Pirie, telephone (086) 32 2121.

Club name: South Coast Amateur Radio Club.
Club call sign: VK5ARC.
Meeting place: Community Centre, Baden Tce, O'Sullivan Beach, SA (adjacent Netball Courts).
Day and time: Tuesday and Thursday evenings 7.30pm to 9.30pm.
Affiliation: Nil.
Net frequency: 3525kHz, 3575kHz and channel 8 FM repeater.
Contact: President, P. J. Wilson, 22 Duval Drive, Morphett Vale. Telephone (08) 3820313 (AH).

"...it's price/performance ratio makes it a bargain..."

Leo Simpson;
Electronics Australia April 1978.



Cat D-2892

The Yaesu YC500S Digital Counter

~~$439~~

$380 INCLUDING SALES TAX!

IT'S EVEN LESS TAX FREE!

500MHz/100mV, AC~DC:

And it's even more of a bargain now we've slashed $59 from the price!

Quite frankly, we would have been surprised if Leo Simpson had come to any other conclusion. We **knew** what fantastic value it was before we submitted it for review.
We compared other 500MHz counters on the market – and were shocked. Brand 'X' with similar specifications is over $200 dearer than the YC-500S. Brand 'Y', again very similar, a massive $300 more.
This is the ideal frequency counter for amateurs & professionals alike. It's also a superb laboratory instrument. It's at home in schools, colleges, etc. It's without peers for servicemen and technicians.

SPECIFICATIONS:

Frequency range:	Inp. 1 – 10Hz to 50MHz Inp. 2 – 50Mhz to 500MHz
Accuracy:	1 part per million
Display:	6 digit LED (dual range 8 digit)
Display Time:	0.1 or 2 seconds
Counting Time:	0.001 or 1 second
Sensitivity:	Inp. 1 – 25mV (20V max) Inp. 2 – 100mV (2V max)
Input Impedance:	Inp. 1 – HI 1 Meg, LO 50 ohms Inp. 2 – 50 ohms
Input capacitance:	Inp. 1 & 2 – less than 20pF
Operating Temp.	0 to 40° C.
Power req.	100/110/117/200/220/240V 50/60 Hz, 12 to 14.5 volts DC
Size:	220 (w) x 80 (h) x 235 (d) mm
Weight:	Approx. 3.2kg.

* 50MHz OR 500MHz FREQUENCY RANGE
* 25mV (LOW) OR 100mV (HIGH) SENSITIVITY
* CHOICE OF MAINS OR BATTERY POWER
* DUAL RANGE 8 DIGIT READOUT
* SUPERBLY ENGINEERED
* F'GLASS PCBS THROUGHOUT

TWICE THE COUNTER; HALF THE PRICE

DICK SMITH ELECTRONICS

SHOP HOURS:
Mon Fri 9AM 5.30PM
Sat. 9AM – 12 noon
(Brisbane ½ hour earlier)

bankcard welcome here

Order value	P&P charge
$5–$9.99	$1.00
$10–$24.99	$2.00
$25–$49.99	$3.00
$50–$99.99	$4.00
$100 or more	$5.50

SYDNEY:
125 York St,
City. Ph 29 1126.
Open 'til 8PM Thursday

SYDNEY:
361 Hume Hwy,
Bankstown. Ph 709-6600.
Open 'til 8PM Thursday

SYDNEY:
162 Pacific Hwy,
Gore Hill. Ph 439-5311
Ample parking at door.

SYDNEY:
30 Grose St,
Parramatta. Ph 683-1133
1st floor – friendly store!

MELBOURNE:
399 Lonsdale St,
City. Ph 67-9834
New: right in town!

MELBOURNE:
656 Bridge Rd.
Richmond. Ph 42-1614.
Easy access: huge stock.

BRISBANE:
166 Logan Rd,
Buranda. Ph 391-6233
Opens 8.30AM

ADELAIDE:
203 Wright St,
City. Ph 212-1962
Now Open. See us!

MAIL ORDER DEPARTMENT PO Box 747, Crows Nest, NSW 2065. Phone 439-5311 Post & Pack extra.

WE HAVE DEALERS RIGHT ACROSS AUSTRALIA – THERE'S ONE NEAR YOU!

Yaesu Musen YC-500S Frequency Counter

While better known for its extensive range of amateur band equipment, Yaesu Musen Co; Ltd does manufacture test equipment, including the YC-500S frequency counter reviewed here; it is a six digit counter offering eight digit resolution at frequencies up to 500MHz. It can be powered from 240V AC mains or nominal 12V dc supplies.

Until a few years ago frequency counters which could measure up to half a Gigahertz were virtually unknown outside research laboratories with seemingly unlimited budgets. Now, Yaesu Musen and other companies can manufacture such instruments at quite reasonable cost and with relatively small number of components.

Dimensions of the YC-500S are 220 x 80 x 255mm (W x H x D) including rubber feet and other projections. Mass is approximately 3.2kg. The case is fitted with a tilting bail for ease of viewing.

Two BNC input sockets are provided, one for frequencies up to 50MHz and the other for frequencies in the range from 50MHz up to 500MHz. On the low range (50MHz is low?), the input loading is switchable — 1 megohm or 50 ohms, with input capacitance less than 20 picofarads. On the high range, input loading is fixed at 50 ohms with input capacitance less than 25pF. Capacitance of the connecting cable supplied is about 100pF.

A bank of three push-buttons on the front panel selects the upper or lower frequency range, the input loading for the lower range and whether the six digit readout is in kilohertz or megahertz. This last button lights a LED beside the appropriate "kHz" or "MHz" legend, moves the decimal point in the readout and switches the gating time between 1 millisecond for MHz readings and one second for kHz readings.

Not to be confused with the gating time is the display time. In a latched readout design such as this, the display time is always longer than the gating time because the circuit has to perform various "house keeping" functions in between each gating (or counting) period. Thus, for MHz readings, the display is updated ten times per second and for kHz readings, once every two seconds.

If readings are being taken in MHz, the resolution of the measurement may be increased by switching to kHz. This lights an "over-range" LED, to indicate that the display does not indicate the actual measured frequency but the digits of less significance. The over-range facility allows eight-digit resolution on both frequency ranges.

The YC-500S may be powered from 240VAC mains or nominal 12VDC supplies. Supply connection is via a 4-pin male socket on the rear of the case. When connected to the power, the 10 MHz timebase oscillator is always on, whether or not the counter is switched on. A standby LED indicates when the oscillator is running if the counter is switched off. The continuous running of the oscillator is to obtain the best stability.

Actually, the YC-500 is made in three versions: YC-500J, 500S and 500E. The difference in these three models is the accuracy and type of the timebase oscillator. The 500S model reviewed here has a timebase accuracy of .0001%, or 1 part per million. This applies for a temperature range of 0 to 40 degrees Celsius.

Input sensitivity is about 25 millivolts RMS over the range 20Hz to about 20MHz, reducing to about 50mV at 50MHz. On the 50MHz to 500MHz range, the sensitivity is better than 100 millivolts up to 500MHz and about 30mV or better between 100 and 200MHz. These figures are displayed in a graph in the well-written and comprehensive instructional manual for the YC-500.

Removing the top and bottom covers of the YC-500 reveals a neat and deceptively simple-looking internal layout. There are five PC boards. One is for the timebase oscillator and first decade divider stage, which provides a buffered 1MHz output to a rear panel BNC socket.

The double-sided TTL counter PCB is the largest and has the LED readout PCB mounted perpendicularly at the front edge. The remaining PCB's are for the selector switch bank and for the separate screened "front-end" which employs ECL (emitter coupled logic) integrated circuits.

Checked in our laboratory, the YC-500 confirmed its specifications, as far as we could check — our VHF generator only runs up to 300MHz. We found that the unit would measure up to 75MHz on the nominal 50MHz range and the sensitivity figures were found to be quite conservative. In short, we were impressed.

Anyone in the market for a well-engineered high-performance frequency counter just has to consider the Yaesu Musen YC-500S. Its price/performance combination makes it a bargain.

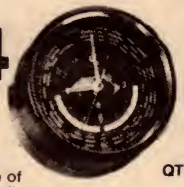
Our sample came from Dick Smith Electronics who presently have it available on special offer at $380 including sales tax. It is available at this price, with sales tax deducted, to schools and technical colleges. (L.D.S.)

bail Specials

A selection from the wide range of Ham radio equipment and accessories available at Bail.

24 HOUR WORLD CLOCK

QTR-24



QTR-24

priced at $33

QTR-24 is a new addition to the range of Yaesu fine instruments. With a glance the time in any principal city or time zone can be simultaneously co-ordinated with local time on a 24 hour basis. The QTR-24 is powered by a 1.5V dry cell, which has a normal life of approx. one year.

NEW! FT7 Mobile

only $578

The all solid state FT7 20w, 12V mobile tcvr. provides high performance on the 80-10m bands. Compact and lightweight, it supersedes the successful FT75B and includes built-in VFO, prcvision for CC operation, single knob tuning, NB, plus many more desirable features. Ideal for novice and O.T.

LOW PASS FILTER

Keep your neighbours as friends — reduce or eliminate TVI with a low pass filter. Properly attached to output of Amateur or CB Tcvr. attenuates all harmonics in TV channels or FM band.
DRAKE TV-42 LP 3 section 300w — $25.00
YAESU FF50-DX 3 section 1kW — $39.00
(not illustrated):—
KW Decca 5 section 1kW — $59.90; LP7 Low power $10.50.

HAVE YOUR OWN 10m MOBILE

GTX-3325 SSB/AM 23 Channel CB — You Modify it for 10m coverage!

An economical way to launch into 10m mobile or DX. Set comes complete with mobile mount, mic, power cable, operating manual with original circuit.

Price only $99.95

SWR METER

RS-101 SWR. Power Meter
Compact and rugged unit for CB radio antenna installations. A special function switch is utilized for easy operation. Power 0-10 watt. SWR meter 1:1-1:3. **Priced at a low $14.00.**

BALUN

Reduce RF radiation from your feedline. 1:1 Baluns for beams and dipoles. Power rating 2kW PEP.
Hy-Gain BN-86 $30 (illustrated)
Western BA1 $22.
300 Ohm model to be available later

DIPOLE TRAPS

Multiband HF Dipole trap sets
Make your own 80-10m trap dipole. Kits consist of 2 weather sealed trap coils and special centre insulator. Dimensions included with kit.
KW Decca $38.
Western $35.
(Wire, coax or twin-feeder, and end insulators extra).

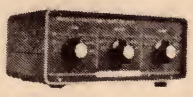
SWR METER

OSKER SWR200 — SWR and Power Meter
Easy-to-operate and high sensitivity standing wave ratio and power meter for practical use by radio amateurs. Push button 75 Ohm or 52 Ohm operation. Power range 0-200w and 0-2kW, accuracy — + 15% at SWR 1.
Priced at $75.00.

Also available — SWR 40, $23 00 and FSI-5 at $32.00.

ANTENNA COUPLER

Extremely important, especially with modern all-solid state transceivers, is the maintenance of a very low SWR to avoid destruction of costly high-power P.A. transistors. An antenna coupler enables precise adjustment with almost any antenna.



HC 500A-160-10m, up to 500w pep $119
Other couplers available from 200w up to 2.5 kW — including FC301 Yaesu-160-10m, up to 500w pep, $195.

DUMMY LOAD 10W peak

Dummy load built into a PL-259 plug for easy connection to the back of your rig. No need for large cans, this has a built-in lamp which lights up on transmission, showing AM carrier with modulation varying the intensity of the lamp.

$1.60

Write for our catalogue detailing more of the latest Yaesu equipment and accessories available from BAIL. Prices and specifications subject to change. Please include 40 cents for postage.

bail ELECTRONIC SERVICES

FRED BAIL VK3YS
JIM BAIL VK3ABA

60 Shannon St., Box Hill North, Vic., 3129.
Ph. 89 2213

Australian Agents for Yaesu since 1963

Radio amateur equipment from B.E.S. also sold by —

W.A.	Radio Communication Services, H. R. PRIDE, 26 Lockhart St., Como, 6152	Ph. 450 4379
	WILLIS TRADING CO., 429 Murray Street, Perth 6000	Ph. 21 7609
S.A.	FARMERS RADIO PTY. LTD., 20 Stanley St., Plympton 5038	Ph. 293 2155
TAS.	G. T. ELECTRONICS, 131 Westbury Rd., South Launceston 7200	Ph. 44 4773
	PRINS RADIO, 123 Argyle Street, Hobart 7000	Ph. 34 6912
N.S.W.	Aviation Tooling, STEPHEN KUHL, 104 Robey St., Mascot 2020	Ph. 667 1650
	Amateur & Novice Comm. Supplies, W. E. BRODIE, 23 Dalray Street, Seven Hills 2147	Ph. 624 2691
	DIGITRONICS, 186 Parry St., Newcastle West 2302	Ph. 69 2040
	RIVERCOM, Sid Ward, 9 Copland St., Wagga Wagga 2650	Ph. 21 2125
QLD.	H. C. BARLOW, 92 Charles St., Aitkenvale, Townsville 4814	Ph. 79 8179
	MITCHELL RADIO CO., 59 Albion Rd., Albion 4010	Ph. 57 6830
A.C.T.	QUICKTRONIC, Jim Bland, Shop 11, Altree Crt., Phillip 2606	Ph. 81 2824

JAS7778-40

SHORTWAVE SCENE

by Arthur Cushen, MBE

Radio Surinam changes frequency, increases power

The recent change of frequency for Radio Surinam has resulted in very good reception of this small South American country. Surinam had previously not been heard on short-wave for many years until its transmission was reactivated in March, 1977.

The recent frequency change and increase in power of Radio Surinam has resulted in its good reception in this area. The station is now using 4850kHz with a power of 10kW, and generally opens around 0835GMT. Using the slogan SRS and broadcasting from Paramaribo, it first appeared on short-wave in March 1977 using 4780kHz and 1kW.

Programs include a broadcast in Indonesian up to 0930GMT and then transmissions in Dutch. Commercial announcements are given in both languages and news and devotional services have been noted, while some announcements in English have also been broadcast.

Our first reception of Surinam was in 1941 when the station used the call PZX, and operated on 11516kHz with power of 750W and relayed the medium wave program. The verification card had a photograph removed by the censor when it was received in our mail.

RADIO YUGOSLAVIA

For many years short-wave broadcasting from Yugoslavia has been broadcast on a restricted basis with the station being known as Radio Belgrade. Earlier this year, a new organisation known as Radio Yugoslavia took over short-wave broadcasting with the aim of broadcasting world wide. The initial step was to use Radio Belgrade transmissions for 10½ hours each day and broadcast in Albanian, Arabic, Bulgarian, English, French, German, Greek, Russian and Spanish.

When the station was planned it was announced that the number of languages would be increased from 9 to 30 and that the short-wave service would be beamed to Europe, North Africa and other continents. Most of the programming will be for Yugaslavs temporarily employed overseas.

The broadcasts of the new Radio Yugoslavia have been heard on 6100kHz with English 1830-1900GMT. There is some interference from Radio Moscow.

NEW DX SESSION

The Spanish National Radio has commenced a weekly DX session in English and this is broadcast on Saturdays at 2117 and 2217GMT. Three frequencies are used, 6100, 7155 and 9505kHz and the station is using the new slogan "Radio Exterior de Espana".

The Belgium Radio, which for many years has had its own DX Session, has now formed a listeners club and is inviting applications for membership. In an introductory letter, the station submitted six new verification cards which they will be using to confirm reception, as well as a selection of car stickers. Further information about the listeners club is available from Paul Renard, DX Editor, Belgium National Radio 202, 1040 Brussells, Belgium.

The DX Session is broadcast in English on the second and fourth Sunday of the month 0015-0100GMT on 6065 and 9675kHz. A transmission to Africa 1715-1800GMT on 9755 and 11940kHz also carries the same program.

RED CROSS TESTS

The International Red Cross in Geneva is continuing tests on 7210kHz with transmissions in various languages. The broadcasts are carried out between 0600-0700, 1130-1230, 1700-1800 and 2200-2300GMT.

Broadcasts in English will be heard on Monday May 22, July 24, September 25 and November 27. Current transmissions are carried out on Wednesdays and Fridays in French, German, Spanish and Arabic. The transmitter used is loaned by the Swiss Broadcasting Corporation.

During the periods of the tests the BBC, which has prior use of the frequency, stands by to allow the tests to be carried out without interference. Reports should be sent to the Radio Division, International Committee of the Red Cross, Geneva, Switzerland.

NEW VILA SCHEDULE

Radio Vila in the New Hebrides has increased its schedule since the country became independent in January. The islands, since 1887, had been jointly governed by Britain and France, and broadcasts were always in English and French, as well as Pidgin. The station also uses the British and French National Anthems when it ceases transmission for the day.

Since independence, Radio Vila on 3945kHz has extended its schedule to close down at 1000GMT. Programs in Pidgin have been observed to 0845GMT, and then broadcasts in French up to 1000GMT. The station no longer closes with a national anthem.

RADIO NORWAY SCHEDULE

Radio Norway in Oslo broadcasts in English for 30 minutes each Sunday during the last portion of their transmission. In this session, broadcast 0800-0830 and 1200-1230GMT, letters from listeners are answered. The session called "Listeners Corner", was started many years ago by Arne Asgaard. During the session he answered questions about Norway from listeners all over the world.

The present schedule, valid to May 6, shows that the two transmissions best received in this area are broadcast 0700-0830GMT on 11850, 11895 and 15135kHz and 1100-1230 on 15345 and 21730kHz.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WAST, 10 hours for EAST and 12 hours for NZT.

SPECIAL PURCHASES

GARRARD Model SL65B

RECORD CHANGER AT LESS THAN 1/3 LIST PRICE — $29.50
(RECOMMENDED RETAIL PRICE $110.00)

SUPPLIED WITH GOLDRING MAGNETIC CARTRIDGE AND DIAMOND STYLUS.

CAN BE SUPPLIED WITH SHURE M75-6 MAGNETIC CARTRIDGE AND DIAMOND STYLUS A $2.50 EXTRA
ALSO AVAILABLE WITH CERAMIC CARTRIDGE
ALL CHANGERS NEW IN ORIGINAL CARTONS

A precision automatic and manual record-playing unit fitted with Garrard Synchro-Lab4 pole shielded motor to provide constant speed conditions for the 10½ inch aluminium turntable.

The low resonance tubular pickup arm is counter-balanced with a resiliently mounted weight to permit light sensitive tracking, and the slide-in cartridge carrier enables styles inspection and the interchange or replacement of cartridges to be carried out simply and quickly.

Fine stylus force adjustment and bias compensation are both calibrated for accurately setting the arm to give optimum playing conditions for the chosen cartridge.

The fluid-damped level-type cue and pause control ensures gentle lowering of the pickup to the surface of the record.

A short spindle is supplied for single record play records.

Precision engineering is reflected in the styling of the SL65B, which is elegantly finished in black and silver.

POST AND PACKING EXTRA Send SAE for details
NSW $2.75 Vic., SA & Qld $4.75
Tas., WA & NT $6.00 (Reg. post $2.00 extra)

BASE AND PERSPEX COVER AVAILABLE AT **$29.00** EXTRA Plus Postage

NEW STANDARD PM-403 W-24 WATT STEREO AMPLIFIER AT LESS THAN TRADE PRICE

MANUFACTURED BY STANDARD RADIO CORPORATION — A MAJOR JAPANESE ELECTRONIC MANUFACTURER.

$59.00 plus post & packing
NSW **$3.50**
VIC., QLD, SA **$5.00**
WA, TAS. **$6.50** (Reg. post $2.00 extra)

SPECIFICATIONS:
Continuous power 12 watts R.M.S. per channel at 8ohms. (24 watts) at 1KHz
Harmonic distortion at 1KHz 0.5% to 10 watts
Power bandwidth 20-20,000Hz at 8ohms
Frequency response 15-40,000Hz
Signal to noise ratio Aux. 70db Mag. 60db.
Bass control ±10db at 100Hz **Treble control** ±10db at 10,000Hz
Input sensitivity Mag. 2.5mv, Cer, 150mv. Aux 100mv, Tape 500mv.
● TAPE MONITOR SWITCH ● LOUDNESS CONTROL ● SPEAKER SELECTOR SWITCH
● HEADPHONE JACK ● SEPARATE BASS & TREBLE CONTROLS ● BALANCE CONTROL
Dimensions 13½" by 8" by 4" high SUPPLIED IN WALNUT FINISHED **CABINET WITH OPERATION INSTRUCTIONS & SCHEMATIC DIAGRAM**

READ REVIEW ON THE STANDARD PM-403W AMPLIFIER IN NOV. 77 ISSUE OF E.A.

SPECIAL PACKAGE OFFER
Send SAE for details

STANDARD PM-403W AMPLIFIER — TWO GOODMAN-FOSTER SPEAKER KITS AND GARRARD SL65B CHANGER WITH SHURE MAGNETIC CARTRIDGE $155.00.
(Cabinets for speakers and changer not supplied.) Freight and packing extra per rail or air freight.

NEW GOODMANS-FOSTER 3-WAY 4 SPEAKER HI-FI SYSTEM

Frequency Range 45 to 22,000 cycles. Power rating 25 watts. Imp. 8 ohms. Supplied in kit form (less cabinet) each kit comprises two English Goodmans 8" bass units. Foster 5" mid range. Foster 1" dome tweeter crossover components (condensers & inductance innabond, speaker fabric & plans of cabinet. Cabinet dimensions 23" x 13" x 10".

Post & packing extra: NSW $2.70; Vic., SA, Qld $4.70; WA $5.70. (REGISTERED POST $2.00 EXTRA IF REQUIRED) cabinets available.

$39.00 PER KIT

NEW MAGNAVOX — MV50 — 50 WATT SPEAKER SYSTEMS

As featured in Feb. 1976 issue of Electronics Today

Complete kit of parts (less cabinet) comprising Magnavox 10-40 10" bass unit. 625 mid range 6" two XJ3 dome tweeters, crossover network, innabond, speaker silk and plans of cabinet.

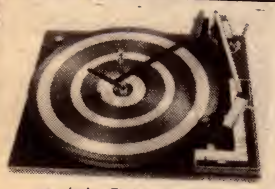
$82.00 PER KIT
freight extra per rail or air freight.
Cabinet available.
830 System also available.

SHURE MAG. CARTRIDGES

New Shure M75-6 Magnetic Cartridges with diamond stylus **$12.50** POST FREE

GARRARD M.82 $57.00 TRANSCRIPTION CHANGER

Supplied with Goldring Magnetic Cartridge with Diamond Stylus. Post & packing (Reg. post) NSW $3.60. Vic., SA, Qld $4.74. Tas $5.50. WA & NT $5.80.



NEW STANDARD B.S.R. C123 RECORD CHANGERS

$20.00

Fully automatic turntable plays up to six records automatically and single records automatically or manually as required. 11" turntable. Bias compensation. Cue & pause control. Record speeds 331/3, 45 and 78 rev./min. Finished in black with silver trim. Player and changer spindles supplied. Fitted with ceramic cartridge. Post & packing extra. NSW $2.70; Vic., Qld., SA $3.70; WA $4.70 (registered post $2 extra if required).

NEW ROLA C12PX 12" HI-FI SPEAKERS

Rola twin cone Hi-Fi speakers. Freq. range 40 to 13,000 cycles power rating 30 watts. Imp-8ohms. Post & Packing: NSW $2.50. Interstate $3.50.

$16.50

GARRARD CC10A RECORD CHANGER $14.75

Fitted with a Sonatone Garrard Ceramic Cartridge Sapphire Stylus supplied with template and instructions.
Post & Packing: NSW $2.50. Inter. $3.50.

CLASSIC RADIO

245 PARRAMATTA RD, HABERFIELD 2045. PHONES 798-7145, 798-6507.

SHORTWAVE SCENE

NEW CHILEAN FORMAT

The Voice of Free Chile, Santiago, which for several months has been broadcasting short news bulletins in several languages, has expanded this service to a full 30 minutes in each language. The languages rotate throughout the day. It is reported that at 1730GMT the program is in Arabic, 1800 German, 1830 Italian, 1900 French, 1930 English and 2000 Russian. According to the BBC, the first 15 minutes is news and commentary and the balance of the program is Chilean music.

Santiago has been heard on 17712, 15150, 11705 and 9566kHz during these times. Our reception on 15150kHz has been up to 2400GMT when this transmitter leaves the air. The frequency of 17712kHz has been heard at 2130GMT but suffers sideband interference from the Voice of America using 1770kHz.

ANGOLIAN CHANGES

Since the MPLA gained control in Angola, all stations have been nationalised and many have closed down. The main station, Radio Nacional de Angola, is now using 11955kHz 0400-1500GMT, with the same program being carried on 9535kHz. The BBC reports that this is a relay of the Domestic B program.

The Angolian Radio announced that Radio Ecclesia, a Catholic Broadcasting station, had been disbanded and all its assests nationalised.

INDONESIAN FREQUENCIES

Later this year all medium wave stations, except those in the Americas, will move to 9kHz separation, thus making 120 channels available on the dial. This reallocation of broadcasting frequencies is due to take effect on 23rd November 1978.

According to the BBC monitoring service, the International Telecommunications Union has allocated to Indonesia 120 radio broadcast channels — 68 will be used by RRI, 20 will be "co-channels" and the rest will be assigned to commercial radio stations.

LISTENING BRIEFS
EUROPE

AUSTRIA: The Austrian Radio at Vienna has made a frequency change from 9770 to 9765kHz and this broadcast is heard to 0800GMT. In the past, the frequency of 9770kHz was also used by Radio Nederland at Bonaire, and this caused considerable interference to the Austrian signal. The new frequency is giving better reception though there is light interference from Radio Moscow on the same frequency.

SWEDEN: Radio Sweden continues to provide excellent reception with its broadcasts in Swedish to Australia and New Zealand 0630-0815GMT. The frequency of 9605kHz is used, and one of our readers, S. H. Niedworok of Blackwood, SA, reports hearing the broadcasts at good strength at his location.

SWITZERLAND: The Swiss Broadcasting Corporation has changed frequency from 11775kHz to 11780kHz for the service to Australia and New Zealand. The transmission includes English 0700-0730 and 0900-0930GMT, with Italian 0730-0800, French 0800-0830, and German 0830-0900.

SPAIN: The Spanish National Radio, which has changed its slogan for overseas broadcasts to the "Spanish Foreign Radio", has a new mailing address, according to John Mainland of Wellington NZ reporting in ADXN. The new address is Box 150039, Madrid 24, Spain. The English broadcasts to North America are well received on 11880kHz at 0300GMT.

LUXEMBOURG: Radio Luxembourg has been heard on the seldom reported frequency of 15350kHz by Harvey Saward of Tasmania, reporting in "Australian DXers Calling". The station was heard in French at 0730 till past 0830GMT.

ASIA

BANGLADESH: Radio Bangladesh at Dacca broadcast in English 0445-0515GMT on 15400, 17890, 21685, and 25685kHz; and 1230-1300GMT on 11900, 15520, 17720 and 21460kHz. Slow speed news is broadcast 1900-1915GMT on 7290, 9500, 11710, and 15285kHz.

MALDIVES: The latest schedule of the Maldives Broadcasting Service includes the use of the new frequency of 3317kHz, 1300-1500GMT. Other frequencies according to Glen Hauser's Radio Canada DX Session, are 6150kHz 0500-0700GMT and 1100-1300GMT; 7225kHz 0300-0500 and 0900-1100GMT; and 9550kHz 0700-0900GMT.

IRAQ: Radio Baghdad has left 9745kHz and is now using 6155kHz 0500-1300GMT. According to the BBC, the program is the "Voice of the Masses". Our own observations indicate that Radio Cameroon on 9745kHz is now clear up to 0700GMT when HCJB opens.

PAKISTAN: Harvey Saward of Tasmania, reports hearing Pakistan on two new frequencies. The frequency of 6235kHz is now used for the World Service in Urdu to the United Kingdom and Europe 1915-2145GMT. The new channel replaces 9465kHz and is in parallel with 7095. 21675kHz has replaced 21590kHz for programs between 0500-0815GMT.

SAUDI ARABIA: A frequency change has been noted from the Saudi Arabian service. James Niven of Mount Gambia, reporting in "DX Post", states that 21590kHz has been heard in Arabic at 1017GMT.

AFRICA

CAMEROONS: Radio Cameroon Yaoynde, which has been reported with an external service in English and French, now operates on 9745kHz, 0400-0730 and 1000-2200GMT. On Saturday the schedule is 0430-2200GMT and on Sunday there is a program called "Cameroon Report" 0615-0645GMT, according to a listener in Uganda reporting to "Sweden Calling DXers".

UNITED NATIONS: Richard Ginbey in South Africa reports that the United Nations Radio's broadcast to South Africa began in March and consists of daily 15 minute programs in English, Afrikaans, Zulu, and one other African language.

The broadcasts are carried by the Voice of America from Liberia; on MW from Botswana on 971kHz; and from Mozambique, either on 917kHz or on the National "A" program. Other African stations to relay the broadcast include Zambia, Tanzania, Uganda, Ghana and Nigeria. Radio Moscow, Radio Peking, Radio France International, Duetsche Welle, Radio Berlin International and Radio Nederland are all expected to help relay the programs. The BBC has declined.

ETHIOPIA: The Voice of Revolutionary Ethiopia, Addis Ababa, has retimed its service for international broadcasts. English is now carried at 1700-1800GMT. French is broadcast at 1800, and Amharic at 1900GMT. Broadcasts are on 7165 and 9610kHz.

Books & Literature

Cassette recorders

CASSETTE TAPE RECORDERS by John Earl. Published 1977 by Argus Books Ltd, Watford, Herts, G.B. Hard covers, 168 pages, 220 x 140mm, illustrated by photographs and diagrams. Price in Australia $13.75.

This is the sixth book by engineer/writer John Earl for the present publisher and forms a companion volume to others on Tuners and Amplifiers, Pickups and Loudspeakers.

As he points out in the preface, cassette tape equipment has matured, in almost spectacular way, from the handy little personal tape format created by Philips, to a hifi stereo format that has virtually displaced the home reel machine, and is rivalling the disc as a source of pre-recorded programs.

With such an unambiguous topic, John Earl has been able to work through it in a thorough and systematic way and, being published only in 1977, it can also be considered right up to date.

There are eleven chapters in all, and to list them is to define the coverage of the book: Introduction — The Compact Cassette — Principles of Recording & Replay — Tape Types — Equalisation and Bias — Noise Reduction Systems — Circuit Techniques — Deck Mechanics and Electronics — The Cassette Machine in Action — Maintenance and Adjustments — The Parameters Explained. The book concludes with an index.

As you can probably judge, John Earl does not attempt to major on individual decks or to provide a compendium of commercial circuits. He is concerned all the time with principles and the result is a text for anyone who really wants to get to grips with the subject. It should also serve as a handy reference reminder to all those details that people like myself tend to forget!

Out review copy came from Thomas C. Lothian Pty Ltd, 4-12 Tattersall's Lane, Melbourne, 3000. Recommended. (W.N.W.)

Microcomputers

THE BEST OF BYTE, Volume 1. Edited by David H. Ahl and Carl T. Helmers, Jr. Creative Computing Press, Morristown, New Jersey, 1977. Soft covers, 216 x 277mm, 376 pages, many illustrations. Price in Australia $13.95.

As most computer hobbyists and enthusiasts will be aware, "Byte" is one of the most established computer hobby magazines in the USA. It began in September 1975, and is now very healthy indeed. It carries a very wide range of articles on small computer topics, and is read not only by hobbyists but by many professionals.

As David Ahl writes in his preface to this book, however, it is difficult to prevent such a magazine from slowly moving up the scale of technicality. If it tries to carry continuing primer-type material for complete newcomers, it runs the risk of losing some of its more advanced readers. And vice-versa: if you carry advanced material, you run the risk of scaring away the newcomers. (Here at EA we know the problem all too well!)

In an effort to solve this problem, David Ahl of Creative Computing Press has collaborated with Byte magazine Editor Carl Helmers to produce this book, which will very likely be the first of a series. It gathers together all of the timeless and introductory material from the first 12 issues of Byte, up to December 1976.

The idea is that the resulting book should be of value to newcomers, and help them to rapidly catch up. After looking through it and reading sample articles, my impression is that it should do that very well.

In fact it seems a book which may well become a "classic", destined to be used repeatedly as a reference by almost anyone interested in or working with small systems.

The review copy came from Computerland, of 55 Clarence Street, Sydney. (J.R.)

World radio & TV

1978 WORLD RADIO AND TELEVISION HANDBOOK, 32 Edition, edited by Jens Frost and published by World Radio and Television Handbook Company Limited, Copenhagen, Denmark.

The WRTH continues to present the world's radio and television stations in detail and with accuracy.

The new 1978 edition uses thinner paper and so is thinner overall, though its pages still number 560. Its printing and other features are improved for easy reference and better presentation.

As is custom, the Handbook has its geographical list by continent and country, as well as stations in order of frequency. Information includes every country, with details such as local time and GMT, addresses, personalities, station frequency, power and operating time, languages broadcast, and details on special programs, and including station verification policy, interval signals and other aids to recognise foreign broadcasts.

The new edition also covers various other details, such as a list of DX

sessions, World Time by country, standard time and frequency stations, religious broadcasters and stations in international waters.

The supplement at the back of the Handbook, Listen to the World, covers 48 pages of articles and these are most informative. A comprehensive report on new receivers and their evaluation shows readers what is available world wide in portables and communication receivers.

Articles also include antennas for broadcast band reception, frequency counters for DXer, log periodic antennaes and clandestine radio are included in the How to Listen section.

The 1978 edition is expected on sale next month in Australia and New Zealand. Readers can obtain details and a brochure from Arthur Cushen, 212 Earn Street, Invercargill, New Zealand, or purchase a copy at their nearest technical bookstore. (A.T.C.)

CHIME KIT. . . from page 43

components are mounted on a pretinned and coded PC board for fast easy assembly.

One simply assembles the PC board according to the component overlay diagram in the assembly manual, paying due care to component polarities, etc. Component values are derived from the parts list. Pay particular attention when handling the CS107/01 microprocessor. This is a MOS device and the usual precautions that apply to such devices should be observed. It should be left in its protective packing until assembly of the rest of the board is complete and then carefully plugged into its socket, taking care not to touch the pins.

In our case, it took only about 2 hours of actual work from unpacking to switch-on. The unit functioned exactly as expected, and no problems were encountered during construction. Undoubtedly the job could have been done faster, but we felt it wise to proceed carefully through the assembly manual, ticking off each step and checking carefully as we progressed. Careful assembly can sure save a lot of hassles later on!

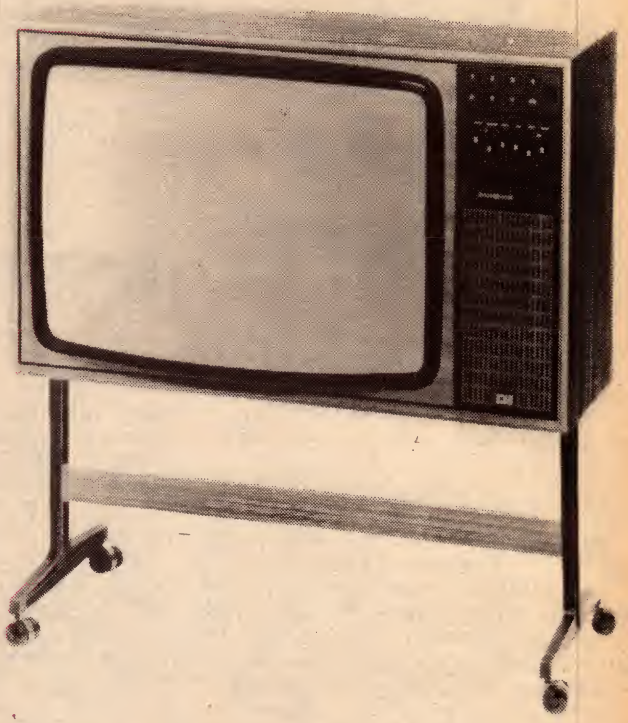
In the unlikely event of difficulties, the assembly manual contains a brief (but comprehensive) troubleshooting procedure. And, if you are still unable to solve your problem, then the kit may be returned to Dick Smith Electronics for repair at normal service rates. Note that the service back-up offered by Chromatronics in the assembly manual is not valid for Australia.

The Chroma-Chime kit retails for $49.50. It is available from Dick Smith Electronics Pty Ltd (catalog No. K-2020), who have stores in Sydney, Melbourne, Brisbane and Adelaide. Alternatively, the kit may be ordered through Dick Smith's mail order department at PO Box 747, Crows Nest, NSW 2065.

New Products

New Decca colour sets released through Trident

Typifying modern design, a new series of British made Decca TV receivers have recently been released in Australia through Trident Television Pty Ltd. The 26-inch model pictured features touch tuning, UHF coverage, separate bass and treble controls and the 20AX picture tube and deflection system.



The 26-inch Decca model EZ1012, as reviewed. For internal use, Decca identify the new all solid-state receivers as "Australian 80 and 100 series using type 84 chassis and type 104 chassis".

The earlier model Decca 33 "Australianised" hybrid receiver was favourably reviewed in July 1975 and is only now disappearing from show rooms after having been sold under at least three brand names.

We gather that an Australian influence was evident quite early in the design of the latest all solid-state series, when there was collaboration between Decca engineers in Britain and HMV engineers in Australia, involved in a parallel development. It was envisaged that HMV might draw on the Decca production line in the event of local facilities not being able to keep up with the demand. In fact, this situation did not eventuate.

However, the Decca chassis found wide acceptance in the European market and for rental purposes in the United Kingdom. Those which have now been imported into Australia are therefore not from the start of a production run, subject to the usual "teething" problems. Moreover, on the insistence of Trident Australia, they include as standard those desirable modifications which have emerged from experience in the field overseas.

Having in mind the receiver's planned role in the colour rental field, it is not surprising to find that extreme emphasis has been placed on access for service.

The moulded back cover is held on by two quick-release screws and can be removed literally in seconds. This gives immediate access to most of the components on the vertical chassis but, once again, it is but the work of seconds to swing the chassis upwards on in-built pivots to gain access to other areas.

Trident's chief engineer, Mr Stan Hill, stressed to me that the pivot arrangement is a very reliable one and not prone to the weakness of some such arrangements which can give way and deftly knock the end of the picture tube! At the same time, the removal of a few push-on connections allows the entire chassis to be unhitched and carried to a table for closer examination.

Major sections of the circuitry are mounted on PCB modules, with plug-and-socket connections and secured by quick release clips. While module sockets, IC sockets, &c are themselves a potential source of trouble, Decca appear to be satisfied that those being used in these receivers are substantially free from this complaint. This appears to be borne out by a very promising low failure rate.

A major difference between the receiver pictured and its European counterpart is that it uses an Australian-made Philips microswitch tuner, shipped to Britain for factory fitting. It provides for access to eight channels, which can be individually set by the installer or by the user, covering any combination of VHF and UHF stations. One channel invokes modified scanning time constants which make it particularly suitable for use with an external video playback unit.

Selecting a channel involves pulling out a drawer just below the control knobs, deciding whether the wanted station is in Band 1, Band 2 or UHF, setting a miniature slide switch as necessary and then moving the thumbwheel until the wanted station is tuned in as accurately as possible. When the drawer is pushed in again, the automatic frequency control takes over to optimise the tuning.

While the eight selector buttons — in two rows of four — is a generous provision, a possible point of criticism is that the channel indicator readout indicates only 1 through 8, requiring some interpretation by the user. In Sydney, for example, a logical approach is to set the top buttons in order for channels 2, 7, 9, and 10. To select channel 2, you press the first button and get a corresponding readout of "1". It sounds confusing but, with only four stations to choose from, it causes no real hassle.

Apart from the mains off-on button below the speaker grille, all the remaining controls are sliders: Contrast, Brightness, Colour, Bass, Treble, Volume.

In terms of styling, the new Decca receivers continue the family likeness established by the early 33 series models, with a neat but entirely functional cabinet and stand and a fully exposed picture tube faceplate. There is a marked reduction in depth, however, because of the changeover to a 110-degree picture tube.

As mentioned earlier, the receiver uses a Philips 20AX in-line picture tube and deflection system, although branded Mullard in the particular instance.

In submitting the EZ1012 model for review, Trident pointed out that there are three other receivers in the same range:

High precision digital thermometer

A new quartz digital thermometer for use in precision laboratory, industrial and process control applications has been announced by Hewlett Packard. Designated the Model 2804A, it features 0.0001°C resolution and a temperature range from -80° to +250°C.

Hewlett-Packard claim that their new HP Model 2804A Quartz Thermometer is more rugged and easier to use than standard grade platinum thermometers. The unit is also said to outperform industrial platinum, thermistor and thermocouple thermometers in terms of stability, repeatability, accuracy and probe interchangeability.

Since quartz sensors convert temperature into frequency rather than changes in resistance or voltage as in some other thermometers, the 2804A is relatively free of noise pickup problems. Long cables, earth loops and proximity to electrical noise sources do not affect this instrument.

Using a seven-digit readout, the unit requires no bridge balancing, no need for the user to refer to voltage or resistance versus temperature tables or curves, nor any need for external equipment such as a reference junction.

Front panel pushbuttons let the user easily select temperature measurements from either quartz probe, or the difference between the two measurements. The display can be set to show measurements with a resolution of either 0.01, 0.001 or 0.0001°C. Readout can be switched to degrees F by changing an internal switch.

Each quartz sensor is individually calibrated and the calibration data provided in a calibration module supplied with each probe. In operation, the module is inserted into the 2804A, and the unit's microprocessor computes the exact temperature being measured. Checking calibration requires only an ice bath to check 0°C; no second check point is necessary.

Five full-scale ranges from 0.01 to 250°C can be selected for the analog output. Tests can range from several millidegrees to several hundred degrees, but results will be recorded in a readable manner.

Adding the IEEE-488 output option to the 2804A gives the user the ability to use a computing calculator, such as the HP 9825A, to compute heat transfer rate, for example.

For further information, contact Hewlett-Packard Australia Pty Ltd, 31-41 Joseph St, Blackburn, Victoria 3130.

DECCA COLOUR RECEIVER . . .

- A 22-inch model using the same "104" chassis but a smaller 20AX picture tube.
- A 20-inch model using a Toshiba in-line picture tube and an "84" series chassis which incorporates the somewhat different geometry circuitry involved.
- An 18-inch model using a Toshiba in-line picture tube, the "84" series chassis and a VHF only turret tuner.

Our reaction to the range was limited to the 26-inch receiver only, but it was again, very favourable.

To those accustomed to an optimally adjusted delta gun tube, and blessed with keen eyesight, the first reaction to any vertical stripe (in-line gun) tube is that the picture is somewhat coarser, because the vertical stripes and the horizontal scanning lines both tend to be more apparent.

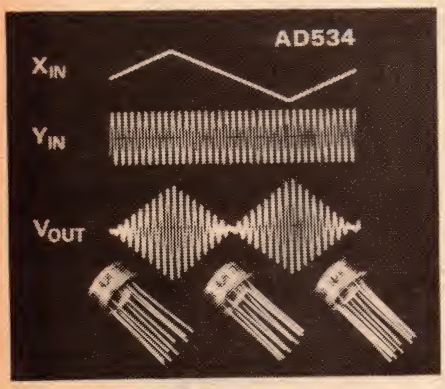
However, under normal viewing conditions, the awareness rapidly recedes and other qualities of the picture dominate. Definition, brightness, contrast and colour values were all excellent on a straight-out-of-the-carton basis, while one had to search diligently to find any flaw in the purity, either on uniform tint backgrounds or on monochrome pictures.

On a broadcast test pattern, convergence, colour values, the grey scale, vertical and horizontal linearity, circle dimensions, &c, were all well up to modern commercial standards. The sound was clean and free from frame buzz, while there was no sign of any problems with the RF and IF systems. Indeed, anyone accustomed to the old turret tuners would find the instant-change microswitch system particularly appealing.

All told, we would have to rate the model as reviewed, the 26-inch EZ102, as an excellent receiver and good value at the retail prices being asked.

The new Decca all solid-state receivers are being offered through Trident's own stores and through other retail outlets. For further details: Trident Television Pty Ltd, 152 Bunnerong Rd, Pagewood, NSW. (W.N.W.)

Monolithic 4-Q IC multiplier



A monolithic, four-quadrant multiplier with accuracy twice that of previous IC multipliers has been introduced by Analog Devices Semiconductor.

The new laser-wafer-trimmed AD534 is available in five versions, and includes the AD534L which features a maximum multiplication error of ±0.25% at 25°C. Maximum offset voltage is 10mV, and nonlinearity is 0.1% maximum. Noise is only 1mV RMS from 10Hz to 5MHz.

Enquiries to Parameters Pty Ltd, 68 Alexander St, Crows Nest, NSW 2065.

Letters to the editor

Micro enthusiast

I am writing to thank you for your articles about microprocessors over the past eighteen months or so. I have built the VDU, the cassette interface, and a KT9500/ 2650 system, and nothing I have tried before from your projects has given me so much pleasure. This is from one who cut his teeth on the 1946 Standard Dual Wave Receiver (RF stage, push-pull output, 12" dynamic speaker — all great in its day, and still a great radio) and has passed with the help of your magazine through transistors, amplifiers, stop watches, TV servicing and a lot more.

As a hobbyist for more than 30 years, I must congratulate EA (and R and H) on your ability to teach me and to remove the mystery from developing technology. I am astonished at what your projects have done for my soldering and my general knowledge of electronics. The best thing, I think, has been the fact that, even when I did not really know what I was doing, I found that by following your instructions, I got things to work and then found out why.

To return to microprocessors: having built your 1977 cassette interface, and "recorded" about 500 bytes on one occasion without transferring the lead from the output socket to the microphone socket on the tape recorder, I added a DIN socket so that both play and record leads would always be connected. This left me with a couple of unused 3.5mm sockets. I also took note of the fact that my tape recorder did not like to play into the high impedance load of the cassette interface, and added the 22 ohm resistor recommended in your article. Having reduced the load impedance so far, I tried an earphone in the unused play socket of the cassette interface, and found as I had hoped, that I could hear what was happening in both the load and dump modes.

This is a great convenience for finding the place on tapes accurately without having to unplug and replace leads, and it lets me know the progress of a load. Also, since I have a bit of software called a "relocating loader", I can load a tape designed for one location into any location in RAM that I have available by picking up the blanks at the beginning of a 236 byte block. Perhaps you would like to pass the earphone idea on to the other readers.

I have added a cursor to the EME VDU, and also switched the alternative display modes. I find for the hobby/games use I make of the microprocessor, that the 32 x 32 format is much more pleasant and useful than the 16 x64 format, and I use it almost all the time.

I think I am enjoying the microprocessor so much because it has three levels of activity. Building it and making it work was satisfying; writing soft-ware is a challenging (and time consuming) activity; and playing with the finished software is real family entertainment.

Once again, thank you for leading an amateur of such long standing into such an interesting new world.

N. H. Campbell,
Lenah Valley, Tasmania.

COMMENT: Thank you for your courtesy in writing. I'm sure readers will find your idea of interest and value.

Abbreviations

I consider yours to be the best presented magazine of all those available in Australia. I always feel at home reading an ELECTRONICS AUSTRALIA ... except for one small thing. I, as well as most of my colleagues, feel you use far too many abbreviations, which tend to hamper reading articles, having to translate all of those silly little letters.

M. W. Shegog,
New Town, Tasmania.

COMMENT: It is hard to avoid the use of abbreviations in electronics, because many of the terms used frequently are quite long if written in full. We do try to explain the abbreviations fairly frequently.

Op-amp articles

Your series, "Op-Amps Without Tears" has been thoroughly instructive. Because op-amps are now one of electronics' major building blocks, I consider your series of articles of sufficient importance to be printed in a book form in a similar way to the "Fundamentals of Solid State".

As you know magazines tend to get borrowed, lost and cut out. I hope you will give serious thought to investigating the potential market for such a printing and look forward to being able to purchase such a copy.

B. Plummer,
Hastings, N.Z.

COMMENT: The book-rights to the articles concerned were retained by the author concerned, by arrangement. However I understand that they are being published as a book by one of the British publishers. Copies are likely to be available here soon.

ZOOM FOCUSING MICROSCOPES 900X

$23.95
Battery
and
Mirror
illuminated
Zoom
1200X
Similar To Above
$35.00

P.M.G. TYPE TELEPHONES

Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

$35.00
(2 TELEPHONE SETS)

$2 Cartage to Rail. Freight payable at nearest attended Railway Station.

FOUR CHANNEL VHF TRANSCEIVER

125 to 140 M/hz 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator.

$33.00

EX ABC MAGNETIC RECORDING TAPES ¼"

PROFESSIONAL QUALITY
5" x 600' **$1.50**
7" x 1200' **$2.75**
P&P A. $1.10, B. $2.00, C. $2.25, D. $2.25.

COLLINS INDEPENDENT SIDEBAND TRANSCEIVER TRC/75

Fully synthesised transceiver with am, upper, lower and independent sideband operation, 1KHz steps from 2MHz to 29.999MHz 1 microvolt sensitivity, 2.5KHz bandwidth ssb, 6KHz bandwidth AM 1 RW. PEP max output. Fully automatic tuning of both transmitter and receiver from remote control unit. Complete with automatic aerial coupling unit, mic, headset, etc, 400Hz supply.
Ideal for amateur use.
PRICE $750

COLLINS SYNTHESISED 1 SB RECEIVER

TRC/75 receiver section of transceiver specification as above.
PRICE $400

TELEPHONE WIRE

1 mile twin (2 miles) genuine ex-Army Don, 8 perfection condition $35 per drum, $2.00 cartage to rail freight payable at destination.

RCA 77DX MICROPHONES

PROFESSIONAL QUALITY $75
P&P A. $1.80, B. $3.50, C. $4.55, D. $4.55.

KAISE MULTIMETERS

A compact and handy tester for workshop or lab where quick circuit checks are required.

DC Volts 2.5 to 1.000V (20,000 OHMS per volt) AC Volts 10 to 1,000V (10,000 OHMS per volt) DC Current 50 UA 25 MA 250 MA. Resistance 40 K OHM, 4 MEG OHM Decibels minus 20 DB plus 62 DB complete with instructions only **$23.95** ea, P.P. $1.05. Multimeter similar to above 30,000 OHMS per volt **$29.50** P.P. $1.05.
Only $17.25 ea. Post $1.05

SIEMENS Typing Perforator

240 Volt Type with Keyboard **$57.50**

4 DIGIT RELAY COUNTERS

50 volt DC, suit slot car Lap counters, etc. **$1.25** each. P&P 60c

SENSITIVE ALTIMETERS

Ex RAAF Smiths, **$65** each
P&P $1.10.

NIFE CELLS

1.2 volt, fully charged, 4in x 3in x 1in 4 AH.
$1.50 each. P&P 80c.

5" CRO TUBE

5 BPI **$5.50** each
Post A $1.40, B. $2.25, C. $2.70, D. $3.45.

ARTILLERY DIAL SIGHTS MK2

Can also be adapted as a Dumpy Level or as base for a telescope has full 360? 5½" diam. gunmetal rotating circle. Adjustable elevation and depression. Has top grade ¾" diam. object lens. F.L. 10" with cross hairs, eyepiece, ½" right angle prism — height 10" — weight 3½kgs. With leather carrying case. Original cost $300. Our Special only **$27.50**
P&P A. $1.95, B. $4.25, C. $5.90, D. $5.90.

ZOOM SPOTTING SCOPES

30 x 30
LENGTH 12½", HEIGHT 10"
WEIGHT 1¾ lb
$27.50

60 x 60
Length: 22in
Height: 18in
Weight: 2kg
$67.50

High grade coated lenses. Ideal for pistol and rifle ranges or general viewing. Zooms in from very low to high powers. Complete with tripods.
POST: A. $1.70, B. $2.25, C. $2.40, D. $2.65.

TELESCOPES

25 x 30 **$7.95**
P&P A. $1.70, B. $2.25, C. $2.40, D. $2.65

SPY TELESCOPES

8 x 17 mag size of a rifle cartridge extends to 8". Only **$5.95** each, post 60c.

BINOCULARS

PRISMATIC Coated Lenses. Brand new. Complete with case.

		P&P	
8 x 30	**$32.50**	A	**$1.65**
7 x 50	**$43.95**	B	**$2.75**
10 x 50	**$44.95**	C	**$3.20**
12 x 50	**$46.00**	D	**$3.20**
20 x 50	**$47.50**		

SMALL CLIP-ON POCKET TELESCOPE

15X **$5.20** Post 60c

RECEIVER No. 210

2-16 M/cs **$65.**
Transmitter No. 11 suits 210 **$35.**
24 volt Power supply to suit above **$15.**
Or complete station with Headphones, Mic. Morse Key, Antenna **$110.**

SOLENOIDS

Plunger Type 24V 300MA. Suit electric camera control, miniature trains, radio, etc.
$2.50 P&P 20c
200 MA 24 volt, ½in push movement, **$2.50** P&P 20c

SELSYN MOTORS MAGSLIP

RECEIVERS 2" MK2 $5.50
TRANSMITTER 3" MK2 $15.00
Post Packing A. $1.75, B. $2.75, C. $2.75, D. $3.65.

3000 TYPE RELAYS

P.M.G. 200 ohms — 1,500 ohm Coils **$2.50** each P&P 60c

P.M.G. TYPE KEY SWITCHES. 75c P & P 20c

POSTAGE KEY:

A: NSW
B: Vic, Qld, SA
C: NT, Tas.
D: WA

VALVES

BRAND NEW

65N7GT	**95c**	6BM8	**$1.80**
5U4G	**95c**	6GV8	**$1.50**
EF50	**75c**	CV850	**$1.50**
5Y3	**$2.25**	1H6G	**75c**
2 x 2	**75c**	832	**$5.00**
		6X4	**$1.80**
		VR65	**75c**

P&P 40c

THEODOLITES

Made by Wilds Microptic, with tripod Model T1, reads down to one minute of ARC **$750.**
(Usual Price **$1750**).
Model T2 reads down to one second to ARC **$1000** (Usual Price **$3200**).
Freight payable at nearest attended R'way Stn.

CONDENSER LENS

1½" diam. 4½" F.L. **75c.** 2½" diam 2" F.L. **$1.50** each or **$2.50** per pair. P&P 40c

IMPELLER PUMPS

New gunmetal body. Stainless Steel Shaft, Neoprene Impeller. Up to 15ft. Lift, suitable for almost any type of liquid. Self priming. Ideal boat bilge pump, sullage drains, etc. Approx. size 8" x 5"
⅜" **$25.95**, ½" **$34.95**, ¾" **$39.95**
P&P A. $1.90, B. $2.75, C. $3.20, D. $3.95

MEGGER Battery Operated

No cranking — in vinyl case. Ranges. Meg Ohm 0-1000 Megs. Centre 20 meg. Rated voltage 500 volts. Low ohm 0-1000 ohm OH 1 range 0-1 meg ohm on 1k range. AC voltage 0-250 volts, **$85.00**
Post A. $1.60, B. $2.50, C. $2.75, D. $2.75

WHIP ANTENNAS

8ft in 6 tapered sections, copper plated steel no base **$9.50.**
Post **$1.10**

MORSE KEY	MORSE KEY BUZZERS
$1.75	**$4.25**
Post 40c	Post 60c

MAGNESIUM DRY CELL BATTERIES

Suits PRC 25 and dozens of other uses. 15 volts long life only **$1.50 ea.**
P&P A. $1.65, B. $2.75, C. $3.20, D. $3.20.

AIRCRAFT INSTRUMENTS

Directional Gyros.
AN5735-1 Air Operated.
Dimensions: 6inx5inx5in.
Weight: 2kg
$35

Sperry Artificial Horizon.
AN5736-1 Air Operated.
Dimensions: Length 9in;
Diam. 4½in.
$45.

Slip and Turn Indicators
Electric. Type Mk. 12.
24Vdc.
Dimensions: Length 6½in.
Diam: 3¼in.
Weight: 1kg.
$17.50.
P&P A. $1.60, B. $2.50, C. $2.75, D. $2.75.

TRANSCEIVERS Ex Army

No. C42 set. 36 to 60MHz with 24V power supply, headphone, mic, leads etc. **$65.00**

No. C45 set. 23 to 38MHz with headphones, mic. 24V power supply, etc. **$95.00**

$1.00 cartage to rail, freight payable at nearest railway station.

EX-ARMY TWO-WAY FM RADIOS

1.2 WATTS OUTPUT
SUPERHET
PRC9 AND 9A 27 to 39M/HZ
PRC10 AND 10A 38 to 55M/HZ
WITH HANDSET ANTENNA $25 EA.
Battery $3.50 extra. Harnes $4.50 extra
$2 Cartage to Rail. Freight payable nearest attended Railway Station.

16MM SOUND PROJECTORS IN GOOD WORKING ORDER

240 volts operated complete with Speaker and Amplifier.
RCA **$275**
$1 Cartage to Rail. Freight payable at nearest attended Railway Station.

CB RADIOS

PMG Approved Famous Pony Brand on 27 Meg.
7 transistor model $55 per set of two (hand held).
11 transistor model 1 watt (hand held) **$72 ea.**
5 watt 6 channel **$99 ea.**
Post A. $1.65. B. $2.75. C. $3.20. D. $3.20

COMMUNICATIONS RECEIVER

COLLINS R — 391/URR

Continuous tuning of range 500 Kills — 32MHz in 32 bands. Receive frequency indicated directly on digital counter type readout to within 300Hz. Selectivity adjustable in six steps. From 100Hz to 16KHz bandwidth using mechanical filters. Sensitivity 1 microvolt or better 240 VAC operation — 10 inch rack mount — autotone on eight preset channels available complete with instructions and service manual and tested. **PRICE $500.**

Deitch Bros.

70 OXFORD STREET, SYDNEY 2010

SORRY NO C O D

INFORMATION CENTRE

NUMEROUS QUESTIONS: Can you suggest an amplifier for recording purposes?

"Op-Amps Without Tears", June 77, Fig. 47: what is L1 and how is it made? Can this record amp be connected straight to a tape head?

On Mini-Scamp: Dees it have to be kept plugged in? Can Mini-Scamp be interfaced to Jan/Feb 77 video terminal?

EA August 1977: "Hexadecimal Keyboard"; how is it connected to Mini-Scamp?

3.5MHz Transmitter (EA September 1976): Is the earth lead connected to the negative side of the power supply or is there a separate negative power lead? (As well as the positive power lead and earth lead).

● Our most recent recording amplifier was the Playmaster Stereo Cassette Deck of February 1978 (File No. 1/RA/34). The purpose of L1 is given in the text of the June 1977 article. Briefly, it is to block any high frequency bias energy from reaching the amplifier. Fairly obviously, its exact value would depend on the frequency involved. The amplifier is not designed to work directly into a recording head.

Mini-Scamp does not have to be kept plugged in, but its memory is volatile unless you add battery backup — see the January issue. Details of how to interface it with the video terminal were given in the June 1977 issue.

The hexadecimal keyboard could be used with Mini-Scamp, via a parallel input port of the type shown in July 1977.

The negative supply terminal for the 3.5MHz transmitter is shown on page 53 of the September 1976 issue, marked "earth".

CAN'T GET FM/STEREO: I have a hifi system about four years old which appears to be in mormal working order. When 2MBS was broadcasting from its original position, before the ABC came on the air, the signal came through well on stereo phones. Now they have moved, I cannot get a strong signal from them with any sort of aerial. I've tried different lengths of wire from the original 48in strand, and a commercial 300 ohm indoor dipole. No stereo!

A pick up the ABC at 9/10 signal strength and, on cool evenings, even get them on stereo. As the day heats up, the stereo lamp goes out and the signal reverts to mono.

We are 8.8 miles from the city, in a ground floor unit, halfway up a small hill. Nearly all the tall buildings in Chatswood are between us and the ABC at Gore Hill and the mast which 2MBS uses on the AMP building. Can you please offer an explanation? (I.B., Roseville, NSW).

● If you are indeed in a heavily shadowed position from the FM transmitters, you face the problem that the ABC uses horizontal polarisation, while 2MBS has thus far been transmitting on reduced power, with vertical polarisation. A simple vertical antenna will be wrong for the ABC transmitter and perhaps inadequate for the weaker 2MBS transmission. By the time you read this, 2MBS may have its new transmitter and new horizontally polarised antenna in ise, so that a horizontal dipole will be appropriate for both.

We do wonder, however, whether any of your antennas to date have been anything like adequate, particularly if you are on the ground floor of a steel frame building. If you are not free to install some kind of outdoor antenna, you may have to think in terms of a proper dipole or beam for the FM band, even if it is expensive and unsightly.

But, having said all that, we cannot escape the suspicion that there is something wrong with your FM tuner. Maybe it will have to go back to the agents for a thorough overhaul. Ask particularly that they check sensitivity, and operation of the stereo sensing circuitry.

B & W DM6: In a recent British audio magazine I noticed that there have been some problems when B & W DM6 loudspeakers have been driven with DC coupled amplifiers (brands not stated). The "LF contour" and autotransformer have now been deleted from the current models of the DM6.

For almost a year I have been driving my DM6 with a Quad 405 amplifier which I understand is direct coupled, with an offset voltage of less than 7mV (about 2mV in test reports) and I have not experienced any problems.

In "Electronics Australia" August 1976 page 23 the review of the DM6 points out that there should not be any problems when the offset voltage is less than about 30mV. However, I would be grateful if you could expand on this subject. (K.W.J., Kingston, Tas.)

● Autotransformers in loudspeaker crossover networks can cause a number of problems in the driving amplifiers. First, some amplifiers are unstable when driving transformers, although we are not aware of this problem in recent designs. Second, transformers can cause premature operation of "load line" protection circuitry in some amplifiers and the audible results can be excruciating. Further, amplifiers with these protection circuits can be damaged by the transformer back-EMF when the output transistors turn off. More recent amplifier designs with loadline protection have had diodes connected across the output transistors to prevent damage. Finally there is the problem of amplifiers with high DC offset voltages at the output. This can produce a heavy current in the transformer winding, which can upset the transformer characteristics. Worse, the output transistors can overheat.

This is why we quoted a figure of 30mV as being reasonably safe to sue with the DM6 autotransformer, which presents a DC resistance of 0.8 ohms to the driving amplifier. Your Quad amplifier should be okay as it has very low offset voltage and in any case, it has been designed to be compatible with Quad electrostatic loudspeakers which include transformers. Check the offset voltages of other amplifiers before trying them with the DM6s.

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at $2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

PRINTED BOARD PATTERNS: Dyeline transparencies, actual size but of limited contrast: $2. Specify positive or negative. We do not sell PC boards.

REPLIES BY POST: Limited to advice concerning projects published within the past two years. Charge $2. We cannot provide lengthy answers, undertake special research or discuss design changes.

BACK NUMBERS: Available only until our stocks are exhausted. Within three months of publication, face value. Four months and older, if available, $2. Post and packing 60c per issue extra.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

COMMERCIAL, SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

Marketplace

FOR SALE

CROSSOVER NETWORKS. Lo-loss air cored inductors, non-saturating, non-distorting. Polyester capacitors in H.F. feed. If you're building up K.E.F. 2 way or 3 way, we make the best crossovers in the business. Unconditional 3 year guarantee. Other models too, inc. my horn crossover (E.A. April 72). Send S.A.E. for details and prices. Free quote for your inductors — send circuit. M.D. McLeod, Wattle Electronics, Box 306, PO Unley, SA 5061.

AUSTRALIAN RADIO DX CLUB. The Premier DX Club of Australia now in its 13th year of National operation. Catering for the interests of both SW. Listeners and Dx-ers. The monthly magazine covers the SW and MW. Spectrums. For full details write to PO Box 1570, GPO Brisbane 4001, PO Box 250 Mona Vale 2103, or our Head Office at PO Box 67 Highett, Victoria 3190.

PAGE PRINTERS. MOD 15 $30 to $60 READERS $20. Studio 20 Sales 367 Bourke Street, DARLINGHURST 2010. Tel. 31 3383.

DISPOSAL VALVES. Most types 1930 and later, eg E409, AK2, ECH 35, 27, 45, 287, 6A7, 6D6, 42, IR5, 1T4, Metal 6K7, 6F6, 6L7, etc. SAE for list. Your choice, tested OK, $10 for 5. Mixed as they come, radio and carset types $10 for 40, TV types $10 for 100, all post free in Aust. Be early. O'Brien, 5 Edgar Rd, San Remo, 3925.

TWO (2) ITC 17" TV MONITORS. One (1) Conrac 14" video TV monitor. All precision monitors in excellent condition. Suitable for closed circuit TV and video. Price $150 ono.

One (1) AWA stabilising amplifier in good condition with spare parts, suitable for Video Studeio. Price $200 ono.

Phone Nabalco Pty Limited, 02 27 8371 ext. 69.

LOGIC INTERNATIONAL

For your semiconductor and hardware needs. Send S.A.E. for price list to:
Logic International, PO Box 187, Coburg, Vic. 3058.

LEDs — $15 per 100 — 5mm red with clip $140 per 1000. $8 per 50 or 20c ea. Retail or trade — sample for 40c stamp. Great quality — wide viewing angle — well difused. Also axial electrocap 1000uF/16V same prices but extra 1c each on 40c P&P. Diggerman Electronics, Box 33, Coramba 2466.

DANDY
ELECTRONIC DISCOUNTS
(Cheapest in town)
508 BRIDGE ROAD, RICHMOND, VIC. 3121
Tel. 42-6887

Resistors from 1c. Switches from 30c. Capacitors from 3c. Coils from 20c. Electrolytics from 5c. Trimmers from 10c. Knobs from 3c.

SPEAKERS (Wide range, e.g.)
Twin/Cone 8" 8 OHMS $5.50
Twin/Cone 5" 8 OHMS $3.00
Twin/Cone 5" 15 OHMS $3.00
1" Tweeter 40 WATTS $6.50
3-Way Crossover $6.50

MAIL ORDERS AND TRADE ENQUIRIES WELCOME

OUR MOTTO — CHEAPEST IN TOWN
Mon.-Thurs. 9 am-5.30 pm.
Fri. 9 am-7 pm. Sat. 9 am-12 noon.

SPECIAL OFFER FOR LIMITED PERIOD ONLY. MKS Wima Capacitors — PC Board types:
0.015uF 400V, 015uF 63/100/250V, 0.022uF 400V, 0.22uF 250V, 2.2uF 63V, 0.033uF 250/400V, 0.33uF 63/250/400V, 0.47uF 250V, 0.068uF 100/250/400V, 0.63uF 63V, 1.5uF 100/250V. All @ 35c each. Minimum order 10 (mixed).

C.Mos IC's
4011 — 45c, 4028 — $1.00, 4029 — $1.35, 4049 — $1.00, 4068 — 50c, 4081 — 45c, 4070 — 35c.

TTL IC's
7401 — 35c, 7405 — 45c, 7410 — 35c, 7413 — 95c, 7414 — $2.00, 7417 — 75c, 7432 — 75c, 7447 — $1.00, 7448 — $1.20, 7474 — 80c, 7483 — $1.00, 7486 — 50c, 7494 — $2.00, 7496 — $1.10, NE 555 — 50c, NE 556 — $1.30.

TBA Series
TBA 510 — $1.85, TBA 520 — $1.85, TBA 530 — $1.85, TBA 540 — $2.75, TBA 560 — $2.75, TBA 630 s — $2.00.

Minimum P&P $1.00.

The Electronic Shop, 11 Globe Arcade, Wollongong 2500. Phone (042) 28 8835.

The Illawarra's Mail Order House. Postal and phone queries welcome but SAE is necessary for postal replies.

MICROWAVE EQUIPMENT. X-BAND. Includes Hewlett-Packard 431c Power Meter c/w Thermistor Mount, Tunable Gunn Oscillator, High Power Gunn Diode, Brass Waveguide, Flanges, etc. $180 the lot. Phone (03) 68 4788 bus. hours. Ask for David Mitchell.

SPEAKER BOXES. Hand-made, rigid modular construction, fully cleated. Choice veneers. Excellent acoustically. Vol: 42L. Weight: 18kg. M/order service. For details write: Sherwood Electronics, PO Sherbrooke 3789.

OSCILLOSCOPE — Tektronix model 564B, storage oscilloscope complete with type 3A74 4-channel vertical amplifier and type 3B3 delayed sweep time base operating but has occasional intermittent fault in power supply. With full instruction manuals — $500. Contact Mr Wayne McDonald 03 391-1222.

VARACTOR TV TUNERS. Made to Australian standards, only $15 each plus $1 post and packing. R. F. SYSTEMS PTY LTD, 98 Guthrie Street, Osborne Park, WA 6017.

OSCILLOSCOPE. 5MHz kikusui model 555 good order only $220. Ring Paris Radio Electronics. Phone (02) 31 3273.

TAPE, VIDEO 2 INCH, HI BAND. Limited qnty, 2600ft, $7. Wideband ½ inch, excellent qlty, suit audio, 4800ft, $2. S. Dekker, Box 437, Gawler 5118.

NOTES AND ERRATA

DIGITAL AUDIO OSCILLATOR (January 1978): The 74CO2 gates shown in the circuit were used in an earlier prototype; as the 74154 has active low outputs, NAND gates are required. Etheir 4011 or 74COO gates may be used, instead of the 74CO2 gates shown. Also if problems are encountered with the 74C73 flipflop not toggling, the 100 ohm resistor in the base of the level shifter can be increased to 330 mhms.

BUILDING A DIGITAL MULTIMETER (January 1978). In the circuit diagram on page 57, diodes VR2 and VR4 are shown with their polarities reversed. The Range 2 Ohms Adjust preset (R5) should be in series with R4, between 7 on the range 2 switch and 1 on the range 3 switch. The rotor of the AC-DC switch at the output of the AC converter should have been shown connected to contact 3 of the switch. Q1, shown as a 2SC18490, should be a 2SC1849Q or 2N4014. L1 is shown on the manufacturer's circuit diagram as 2.2mH and on the PCB as 1.5mH.

ADVERTISING INDEX

Pro. Series

ELCASET: Open-Reel Performance plus Cassette Convenience.

Technics RS-7500US tape deck is the result of the latest development in the era of taped music reproduction... the ELCASET... developed to bridge the gap between cassette and open reel decks.

The feature of ELCASET is that the tape is actually lifted out of its case onto the heads which remain stationary just like in open reel decks. This means stability in tape transport, minimising wow and flutter to 0.06% (WRMS) ±0.15% (DIN). Because the tape width is the same as standard audio tape used in open reel decks, and the tape speed is twice as fast as cassette tapes, ELCASET attains greater dynamic range and wider frequency response ratings than cassette performance and even many good open-reel decks.

Besides maintaining the same simple cassette loading and unloading operation the RS-7500US features automatic tape selection (with type indicator lights) and full auto-stop to eliminate strain on tape or transport mechanism.

In every way the Technics tape deck RS-7500US represents a very significant advance in tape technology... offering quality in simplicity.

National Technics hi-fi

WARRANTY AND SERVICE BY HACO

For a National Technics catalogue, please write to:
National Technics Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033

T77.13

Why blame your tape recorder for problems caused by your tapes?

Every day people all over the country go into hi fi dealers with complaints about their tape recorders.

When in reality what they should be complaining about is their tapes.

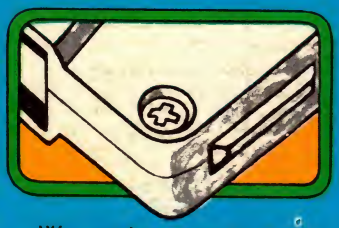
Because the fact is, a lot of the problems that plague tape recorders can be attributed to bad tape.

HEAD WEAR IS CAUSED BY YOUR RECORDER. OR IS IT?

If you have to clean your tape heads more than usual ... for example ... it could be that your tape doesn't have a special nonabrasive head cleaner.

Maxell has one.

If your recorder jams, it can be any number of things. Maxell does something to prevent all of them happening.



We make our cassette shells of high impact polystyrene. And then so they won't crack even after years of use, we finish them to tolerances as much as 60% higher than industry standards.

JAMMING IS CAUSED BY YOUR RECORDER. OR IS IT?

Inside, we use free rolling Delrin rollers so the tape doesn't stick.

And finally, we screw instead of weld everything together because screws make stronger cassettes.

If your tape recorder frequently suffers lapses in sound, it could be the tape is of inferior quality.

Maxell tape is made of only the finest polyesters. And every inch of it is checked for even the slightest inconsistencies.

POOR TRACKING IS CAUSED BY YOUR RECORDER. OR IS IT?

So if you're having problems with your recorder, try a Maxell cassette, reel-to-reel tape.

You might find there's really nothing wrong with your tape recorder, just with your tape.

Switch to Maxell!

maxell
simply excellent

For your free full Maxell Recording Tape write to Maxell Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033